PACIFIC groundwater GROUP

PFAS DRINKING WATER CHARACTERIZATION REPORT ECOLOGY GRANT IAAC2000156

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LIST OF ACRONYMS

DOH	Washington State Department of Health
EDD	Electronic data deliverables
EIM	Environmental Information Management
EPA	Environmental Protection Agency
GIS	Geographic Information System
gpm	Gallons per minute
HAL	Health advisory level
JBLM	Joint Base Lewis-McChord
LIMS	Laboratory Information Management
MCL	Maximum Contaminant Level
PFAS	Per- and Polyfluoroakyl substances
PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
ppt	Parts per trillion
SAL	State Action Levels
TPP	Technical Project Progress meeting
TPUD	Thurston Public Utility District
ug/L	Micrograms per Liter
USGS	U.S. Geological Survey

SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.

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1.0 INTRODUCTION

Per- and Polyfluoroakyl substances (PFAS) have been identified as contaminants of emerging concern by the United States Environmental Protection Agency (EPA) and Washington State Department of Health (DOH). PFAS are a group of man-made chemicals that includes PFOA, PFOS, and many other variants. PFAS may be released into the air, soil, surface water, and groundwater, including sources of drinking water. They are highly mobile in groundwater, resistant to biodegradation, and are considered a toxicant and lifetime-exposure carcinogen at very low concentrations.

Joint Base Lewis-McChord (JBLM) has identified the presence of PFAS compounds in groundwater wells used by the facility. In 2017 and 2018, JBLM held several Technical Project Progress (TPP) meetings to provide information showing known or suspected contaminant locations for PFOA/PFOS[1] within the base boundaries. Additional information has not yet been made available. In the meantime, JBLM staff and consultants are undertaking a multi-year project to identify and characterize the locations of PFAS contamination, and to model the extent of impacts in order to establish a targeted Base clean-up program. The clean-up will be largely focused on soil remediation but recognizes the impacts to groundwater. The scope (reportedly) includes modeling of transport in groundwater. Model completion is not anticipated until 2021 or 2022.

Since the discovery of PFAS contamination in groundwater at JBLM, Lakewood Water District (District) and other local project stakeholders have been monitoring PFAS in their supply wells. As part of its efforts to respond to the growing concerns over PFAS in groundwater, the District requested support from the Washington State Department of Ecology (Ecology) to further research and expand data collection beyond the District's boundaries to better understand local and regional PFAS contamination. Purveyors participating in this study were the District, Parkland Light and Water Company (PLW), City of Dupont, and Thurston Public Utility District (TPUD). Service areas and study wells are shown on **Figure 1**.

Three other purveyors were listed as potential participants in the grant scope of work—City of Tacoma, Spanaway Water Company, and JBLM. Data from the City of Tacoma was not pursued because of the distance of their wells from JBLM. Spanaway Water Company declined an invitation to participate. Drinking water well data from JBLM was solicited but not provided.

Ecology awarded grant funding to the District under contract IAAC2000156 for a scope that includes the following tasks:

- Compile available PFAS groundwater data from participating purveyors in the JBLM vicinity into a project Geographic Information System (GIS) and upload the data into Ecology's Environmental Information Management (EIM) online database;
- Evaluate the data spatially to delineate the extent of groundwater contamination, potential transport pathways;

[1] JBLM is operating under the EPA guidelines for PFAS contamination. Sampling for additional PFAS constituents may be included in their research, but reported results focus only on PFOS and PFOA.

- Evaluate the data temporally to assess potential changes in PFAS concentrations over time to the extents possible; and,
- Provide recommendations for additional work.

This report summarizes Pacific Groundwater Group's (PGG's) findings and recommendations. The regional and local hydrogeology are also described to provide a context for the delineation of PFAS contamination and transport pathways.

PGG's work was performed, and this report was prepared, in accordance with generally accepted hydrogeologic practices at this time and in this area for the exclusive use of the District and its agents. Use of this report and any information or analyses contained herein for any purpose beyond that of understanding the local hydrogeology and the participating purveyor's current PFAS water quality data set is at the sole risk of the person, persons, or organization using the information or analyses. PGG is not responsible for, and makes no warranty for, any other use of the information and analyses presented herein. No other warranty, express or implied, is made.

2.0 FINDINGS

Data collected under this study came from 37 groundwater wells operated by the four participating water purveyors and tapping four regional and local aquifers. Combined, these purveyors serve a significant portion of the population in communities surrounding JBLM. Public health and safety of their water sources are primary concerns for these purveyors and continued monitoring for PFAS is warranted.

PGG's analysis of PFAS occurrence is based on the current EPA health advisory level (HAL) of a lifetime exposure limit of 0.07 ug/L (70 parts per trillion) for PFOS and PFOA combined (PFOA+PFOS). Only one sampled well reported an exceedance result of the HAL. Twenty-two wells reported detections below the HAL, while 14 wells reported concentrations below the laboratory reporting limit (ranging from between 0.0024 to 0.0043 ug/L, depending on the analytical method). The current HAL is expected to be replaced by new State Action Levels (SAL) proposed by DOH for five PFAS compounds. If these regulatory limits are approved, six of the 37 wells would show exceedances based on current reported maximum PFOA+PFOS concentrations measured in the wells.

Based on past studies and modeling, groundwater underlying the Base is expected to the north or west. Most of the PFAS detections documented in this report appear to occur downgradient of JBLM. Although PFAS contamination has been established at JBLM, further assessment of contaminant transport from the Base to purveyor wells is needed. Non-detection of PFAS in relatively deep supply wells downgradient of the Base suggest lower transport potential from PFAS sources (at the land surface) to deeper aquifers (e.g., "Aquifer E"). Consideration of PFAS sources within the study area (both on- and off-Base) was outside the scope of this investigation.

With only 12 of the 37 wells having more than one sampling event to evaluate, time-series trend analysis was limited. Most wells showed no discernable trends, and those with

inferred rising trends were often based on only two samples or had a similar magnitude of variation ("noise") to the inferred rise.

Detailed recommendations are presented in Section 7, and include:

- The project (and Ecology EIM) database should be maintained and updated as new data become available. If possible, data collected for JBLM drinking water wells should be incorporated.
- Ongoing sampling should prioritize off-Base supply wells at highest risk (e.g., existing HAL exceedances, potential rising trends, locations downgradient of JBLM contamination). Upcoming DOH rulemaking is also expected to require increased monitoring by purveyors.
- The incidence of PFAS detections observed in this study could be compared to a wider dataset (particularly in other areas of the state with similar levels or types of development) to gain further context regarding "typical" PFAS occurrence in groundwater.
- Comparison of PFAS occurrence at JBLM and in downgradient supply wells should be ongoing. Communication with JBLM should continue as their investigations progress. Potential sources of PFAS contamination between the Base and downgradient wells should also be considered.
- Interpreting current and future contaminant transport through the complex local hydrogeologic framework should employ both contaminant delineation and groundwater flow modeling. The USGS model (currently under revision) will provide a regional context for groundwater flow directions, but local variations may need to be considered in order to better assess risks of contaminant migration.

3.0 PFAS

Per- and Polyfluoroakyl substances (PFAS) have been identified as contaminants of emerging concern by the United States Environmental Protection Agency (EPA) and Washington State Department of Health (DOH). PFAS are a group of man-made chemicals that includes PFOA, PFOS, and many other chemicals. PFAS have been manufactured and used in a variety of industries around the globe, including in the United States since the 1940s. PFAS may be released into the air, soil, surface water, and groundwater, including sources of drinking water. They are highly mobile in groundwater, resistant to biodegradation, and considered a toxicant and lifetime-exposure carcinogen at very low concentrations. PFAS can be found in:

- Food packaged in PFAS-containing materials, processed with equipment that used PFAS, or grown in PFAS-contaminated soil or water.
- Commercial household products, including stain- and water-repellent fabrics, nonstick products (e.g., Teflon), polishes, waxes, paints, cleaning products.
- Fire-fighting foams (a major source of groundwater contamination at airports and military bases where firefighting training occurs).
- Workplace, including production facilities or industries (e.g., chrome plating, electronics manufacturing or oil recovery) that use PFAS.

- Drinking water, typically localized and associated with a specific facility (e.g., manufacturer, landfill, wastewater treatment plant, firefighter training facility).
- Living organisms, including fish, animals and humans, where PFAS have the ability to build up and persist over time.

PFAS chemicals include many subvariants. Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) have been the most extensively produced and studied of these chemicals. Currently, PFOA and PFOS are identified by EPA under their lifetime health advisory level (HAL). The HAL identifies a maximum level of 0.07 ug/L for PFOA and PFOS combined (PFOA+PFOS) in groundwater.

DOH has indicated its intent to establish State Action Levels (SAL) for five constituents (PFBS, PFHxS, PFNA[2], PFOA, and PFOS) with specified maximum levels for each. The final rulemaking to establish the SALs is underway but is not anticipated for completion until later 2021 or possibly 2022. The current proposed SALs are:

- PFBS 1.3 ug/L
- PFHxS 0.07 ug/L
- PFNA 0.014 ug/L
- PFOA 0.010 ug/L
- PFOS 0.015 ug/l

In the interim while DOH is promulgating the new SAL rules, testing and reporting requirements remain at the EPA PFOA+PFAS HAL of 70 ppt. Accordingly, this study focused on the combined PFOS and PFOA results in the subject wells. **Figure 2** shows the maximum PFOA+PFOS values represented by available data at each study well. **Figure 3** illustrates the PFOA+PFOS concentrations over time at each sample location with sufficient data to calculate the total and to generate a time-series trend of two or more sample events.

4.0 HYDROGEOLOGIC SETTING

The hydrogeology of the Chambers-Clover Creek Watershed has been studied multiple times (Walters and Kimmel 1968, Brown and Caldwell 1985, Noble 1990, Robinson & Noble 2001, Borden and Troost 2001, Savoca and others 2010, Johnson and others 2011). Savoca and others (2010) established the hydrogeologic framework for the current USGS numerical groundwater flow model (Johnson and others 2011) currently used to describe water resources in the watershed[3]. PGG reviewed the general hydrogeologic setting of the study area (**Figure 1**) as discussed below.

[2] Perfluorobutanesulfonic acid, Perfluorohexanesulfonic acid and Perfluorononanoic acid, respectively.
[3] An updated model is currently under construction by the USGS but was not available for this effort. Publication is anticipated in 2021. Future analysis will likely be able to make use of this newer model.

4.1 HYDROGEOLOGIC UNITS

The basic geologic and hydrogeologic setting and the general relationships between the identified aquifer and aquitard (confining) units are based on these previous investigations. Borden and Troost (2001) studied the depths and thicknesses of geologic units across a study area around American Lake and JBLM describing the relationship of the regional aquifers and nearby lakes. That study identified that some units are not uniformly present across JBLM.

The USGS studies (2010 and 2011) synthesized the older layer names and definitions into a more unified regional hydrogeologic framework. Finally, Welch and others (2015) updated the previous USGS studies as part of a larger study including the Puyallup River watershed. PGG adopted these recent USGS unit names and descriptions as shown on **Table 1**. From shallow to deep, these units include:

- A1 aquifer (Vashon recessional outwash, discontinuous)
- A2 confining unit (glacial till and glacial drift, discontinuous)
- A3 aquifer (Vashon advance outwash, regionally extensive)
- B confining unit (largely extensive but occasionally discontinuous)
- C aquifer (regionally extensive)
- D confining unit (regionally extensive)
- E aquifer (regionally extensive)
- F confining unit (regionally extensive)
- G aquifer (regionally extensive, few wells)

The USGS provided the District with a custom hydrogeologic cross section to illustrate the units across the Lakewood area (**Figure 4**). The cross-section location is shown on **Figure 1**.

Numerous wells are completed in the uppermost four aquifers, with the majority of wells being completed in the shallower, regionally extensive aquifers (A3 and C). Deeper wells utilizing the bottom two aquifers E and G are less common due to the expense of drilling such wells. Production rates can be highly variable from each aquifer, ranging from tens of gallons per minute (gpm) in small domestic wells up to over 2,000 gpm in large diameter wells serving community needs.

4.2 GROUNDWATER FLOW SYSTEM

Water-level elevation mapping by Brown and Caldwell (1985), Robinson & Noble (2001), and Savoca and others (2010) has characterized regional groundwater flow directions in the major aquifer systems in the Chambers-Clover Creek watershed. In general, lateral groundwater flow directions across the study area are from east to west or from southeast to northwest, although local variations occur where groundwater discharges to surface-water features. Surface-water drainages also follow this same broad pattern.

Surficial exposures of hydrogeologic units across the study area are generally comprised of units A1, A2 and A3; however, units A1 and A2 can be discontinuous or locally absent. Groundwater recharge predominantly occurs as infiltration of precipitation to the uppermost hydrogeologic unit, and groundwater generally discharges to surface-water features. Groundwater flow has both lateral and vertical components, with downward vertical flow expected in areas dominated by recharge and upward vertical flow in areas dominated by discharge to shallow surface-water features. Confining layer B is occasionally not present allowing hydraulic connection between aquifers A3 and C in some locations (Borden and Troost 2001).

Variable occurrence of shallow aquifers and confining units (extending down through confining layer B) adds complexity to groundwater flow patterns, particularly where a lower permeability unit is not present between an upper and lower aquifer. When aquifers are in direct contact, vertical hydraulic connections could allow contaminants to be transported from a shallower aquifer into a deeper one, thus increasing the risk of contamination in down-gradient sources completed in deeper aquifers.

To assess the general patterns of groundwater flow across the study area, PGG utilized the USGS numerical groundwater flow model (Johnson and others 2011). **Figures 5, 6, and 7** illustrate model-predicted flow directions in each of the respective aquifers. The model represents aquifers and confining units on a regional scale, and therefore may not reflect smaller-scale features that can locally affect flow directions. Flow arrows depict predicted lateral flow directions[4], and arrow colors indicate whether the vertical direction of flow is predicted to have a net upward or downward component. Red arrows indicate that more water is flowing downward into the layer below than is moving upward whereas blue arrows indicate the reverse. Arrow colors do not indicate the magnitude of vertical flow; but in general, the magnitude of lateral flow (within aquifers) is much larger than vertical flow (between aquifers, particularly across aquitards).

The USGS groundwater model predicts regional directions of lateral groundwater flow ranging from westerly (near DuPont) to northerly (near Parkland). Local departures occur based on the geography of the coastline, where groundwater discharges to marine water (for example at the Nisqually River delta). Model predictions generally agree with prior characterizations. Predicted vertical flow components in Aquifers A3, C and E are largely downward across the study area, except near specific stream and shoreline reaches.

While lateral groundwater flow generally dominates over vertical flow, the potential for contaminant transport between aquifers is still a concern. The modeled exposure of aquifers to marine water bodies further affects predictions of vertical flow, and it should be noted that Aquifer A3 largely occurs above sea level. It should be reiterated that the regional formulation of the USGS model may not represent local discontinuities, where local absence of confining units may provide increased potential for contaminant migration between aquifers. Potential contaminant migration pathways are further discussed in Section 6.2 below.

[4] Locations are approximated. Calculations are performed on a per-cell basis but for clarity, not all cells can be shown.

5.0 PFAS GROUNDWATER QUALITY DATA COMPILATION

Following a coordination meeting with the District and Ecology, PGG worked with the four study participants to compile available PFAS laboratory sample results from their wells. PGG imported the data into an internal project database to manage and query the dataset. The database was used to develop maps and graphs shown in this report, to format the data into Ecology templates that were uploaded to the EIM, and to provide data that were incorporated into the District's project website as part of their public outreach. The data processing and Ecology upload tasks are discussed below.

5.1 PROJECT DATA SOURCES

Electronic data deliverables (EDDs) are spreadsheets or delimited files of analytical data generated from Laboratory Information Management (LIMS) systems operated by analytical labs. Transmitting data using EDDs is efficient and minimizes errors because clients do not have to manually enter data into their custom reporting format.

With their permission, PGG obtained EDDs from the analytical labs used by the four study participants for the following PFAS sampling events:

- District: five sampling events between June 2017 and July 2019
- PLW: four sampling events between March 2017 and January 2020
- City of Dupont: five sampling events between April 2019 and April 2020
- TPUD: one sampling event in June 2020

The PFAS samples from sources owned by the District, PLW and the City of Dupont were collected outside the scope of this Ecology grant. PFAS samples from TPUD's sources were collected as part of this Ecology grant. One well source was sampled at each of TPUD's Terry Lane, Crescent Park, and Roy 325 systems. Well construction and identification information for each of the study wells is shown on **Table 2**.

PGG reviewed PFAS summary results from JBLM provided by Base personnel in 2018 TPP meetings. However, the JBLM sample results were only available in unvalidated, summary form and did not include data for Base drinking water wells. Because laboratory reports for the data collected were not provided, the data were not entered into the project database. This limits the direct comparison with purveyor data collected for this study. The JBLM data are presented in **Appendix B**.

5.2 SAMPLED LOCATIONS & AQUIFERS

JBLM has begun a multi-phase process of determining locations of known PFAS contamination on the Base. The Base and its consultants are installing monitoring wells and identifying soil sampling locations to help determine contaminant source locations and associated PFAS concentrations in both soils and groundwater. They are also devising a modeling approach to describe possible contaminant flow paths and creating remediation plans to guide clean-up activities.

Appendix B presents figures provided by JBLM in 2018. **Figure B1** shows the JBLM water-supply wells sampled in 2018 and associated PFAS sampling results. **Figure B2** shows the collection location and results from the Phase 1 monitoring well sampling in 2018. **Figure B3** (from JBLM TPP meeting 3 on September 18, 2018) shows the proposed Phase 2 sampling locations and regions of suspected PFAS soil contamination. At last report, sampling is focused on the Base's groundwater supply wells (Aquifers A3, C and E) and monitoring wells (Aquifers A1 and A3).

The District began selected sampling of its wells in 2016. Wells in proximity to JBLM and those considered of concern based on depth (shallower aquifers) were prioritized. Different sets of wells were sampled in different years, but a total of 14 out of the District's 29 active sources were included. The wells are located north or northwest of JBLM (**Figure 1**) and are completed in three of the four aquifers studied (Table 1). The remainder of the District's supply wells were considered of lesser concern based on distance from the Base, completion in deep aquifers or both.

The City of DuPont and PLW sampled all of their active wells (five and 11 wells respectively). The City's wells are west or northwest of JBLM and are mostly completed in Aquifers C and E. PLW's wells are mostly located east or northeast of JBLM and are completed in all four studied aquifers. TPUD manages multiple, non-contiguous water systems and selected only those wells in proximity to JBLM. The seven TPUD wells are largely shallow being competed in Aquifer A3.

5.3 INTERNAL PROJECT DATABASE

PGG uploaded the EDDs from participating purveyors into our internal project database using an automated import routine so no manual entry was required. The internal project database includes, but is not limited to the following data fields:

- Well ID (includes Owner Name and Well Name)
- Unique Well IDs (UWID) *
- Well Location Coordinates
- Well Completion Interval *
- Link to the Drillers Well Log *
- Interpreted Completion Aquifer based on USGS classification and PGG local knowledge
- WDOH Water System ID *
- PFAS Sample Date/Time
- PFAS Analytical Method
- PFAS Constituent Name
- PFAS Analytical Results, Reporting Limit, Qualifier, and Units

* where available

The sampling locations were each assigned a unique Well ID that included an abbreviation of the purveyor (District = LWD, Parkland Light and Water Company = PLW; City of Dupont = DPT, Thurston Public Utility District = TPUD) and the sampling source ID used by the purveyor (Table 2). Each purveyor was consulted to confirm that the names

used during sampling events (e.g., S-12, E-3) were assigned to the appropriate source/well name in the database.

A summary of the number of analyses by PFAS constituent for each Well ID is presented in **Table 3**. The EDDs also included results for samples collected from the distribution system and field duplicates. These data were also imported to the project database but were not used for this project. **Table 4** provides a summary of PFAS sampling results.

The project database was the primary management tool and input for GIS mapping and analyses. Custom queries were built to facilitate reporting, GIS analyses, the public data interface on the District's website, and for online upload to Ecology's EIM. The project database can be used to upload and manage future PFAS results or other water quality data of interest.

5.4 EIM UPLOAD

Ecology's EIM requires separate uploads of three project elements: Study, Location, and Results. The Study was set up in EIM on October 6, 2020 with the Unique Study ID: IAAC2000156 and Study Name: JBLM Vicinity Purveyor PFAS Characterization. Location information was uploaded on October 20, 2020, and includes details on well name, owner, and well construction. The Results information was uploaded on October 27, 2020 and includes details of the analytical data set, including analytical method, sampling date, results, reporting limit, and qualifiers. A complete set of the EIM Study, Location, and Results fields are presented in **Appendix C**. Required EIM fields were populated and optional EIM fields were populated to the extent the data were available.

The data for this project was accepted by Ecology's EIM Coordinator on December 28, 2020 and is now available to the public.

Consistent with PGG's scope, analytical results for samples collected from the purveyor's distribution system and field blanks were not uploaded to EIM.

6.0 INTERPRETATION OF PFAS GROUNDWATER CONTAMINATION

The following sections describe the spatial distribution of PFAS occurrence among sampled wells, PGG's interpretation of potential contaminant flow pathways based on estimated groundwater flow directions, and an assessment of time-series PFAS trends in wells with two-or-more sampling events.

6.1 SPATIAL DISTRIBUTION OF PFAS OCCURRENCE

Prior sampling of drinking water wells and monitoring wells at JBLM showed PFAS hotspots along the northern boundary of the base, both in the most northeastern areas (e.g. adjacent to McChord Field) and just south of Dupont (**Figures B1** and **B2**, Appendix B). The highest concentrations were noted in a firefighting training site on the east side of the McChord Field runways. JBLM has described the groundwater flow direction in this location as generally to the northwest. This implies that any surface contamination

reaching the groundwater from these hotspots might flow from the McChord Field area toward the District.

Maximum measured PFOA+PFOS concentrations in wells sampled by the four study purveyors are shown in **Figure 2**. The figure does not specify the completion aquifer of the wells, and groups concentrations between 1) non-detect, 2) detection above the 0.07 ug/L HAL, and 3) detection below the HAL. Laboratory results are summarized on Table 4, which also indicates that that laboratory reporting limits for both PFOA and PFOS range from between 0.0024 to 0.0043 ug/L. **Figures 5, 6 and 7** show maximum measured PFOA+PFOS concentrations by completion aquifer along with regional groundwater flow directions estimated by the USGS model.

From the shallowest aquifer (A1) to the deepest aquifer (E), two wells were sampled in Aquifer A1, 13 wells were sampled in Aquifer A3, 13 wells were sampled in Aquifer C and 9 wells were sampled in Aquifer E. All 37 wells are shown on **Figure 2**, whereas Figures 5, 6 and 7 show only one symbol where multiple wells share the same location.

Two wells in Aquifer A1 (PLW-Well-7 and PLW-Well-9) showed PFOA+PF0S detections below the HAL (Figure 2). These wells are located northeast of McChord Field.

In Aquifer A3 (**Figure 5**), PFOA+PF0S detections are noted along the western JBLM boundary in both the DPT and LWD water system boundaries. LWD Well G-2 is the only purveyor well noted in this study where PFOA+PFOS exceeds the HAL. LWD Well L-1 (more distant from JBLM) shows a non-detect, as do several wells operated by TPUD east of the base.

Multiple detections are also noted in Aquifer C (**Figure 6**). DPT and LWD wells (again along the western JBLM boundary) show PFOA+PFOS detections below the HAL. PLW and TPUD wells completed in Aquifer C east of the base show variable presence of PFOA+PFOS, with one of three wells showing a detection (below the HAL).

Almost no PFOA+PFOS are detected in Aquifer E, except in the southern DPT water system service area just west of JBLM along the area between DuPont and the Nisqually River Delta (**Figure 7**). At this location, Aquifer E has already received the maximum downward flow from aquifers above it before it discharges to marine water. This well (DuPont HH Well 1) has the highest values of the City's samples, whereas nearby DuPont BH Well 2 did not detect PFOA+PFOS.

6.2 POSSIBLE CONTAMINANT TRANSPORT PATHWAYS

Based on regional groundwater flow directions estimated with the USGS groundwater model, wells located within the District, DPT, and PLW water-system boundaries are all expected to be downgradient of JBLM. Given that PFAS detections at JBLM are documented near the base boundaries adjacent to the District, DPT, and PLW water-system boundaries, it is possible that contamination is migrating off-base towards these water-supply wells. Evaluating off-base land uses near supply wells with PFAS detections was outside the scope of this investigation; thus, PGG is currently unaware of other potential PFAS sources between the JBLM boundary and the affected wells.

Modeled groundwater flow directions between JBLM and the TPUD service area are more variable, such that it is more difficult to draw inferences about possible contaminant transport in this area. The TPUD wells generally appear to be upgradient of the Base.

Most notable is the general lack of PFAS detections in sampled off-base wells completed in Aquifer E. The data suggest that the magnitude of downward flow to Aquifer E is generally insufficient to cause large contaminant migration potential to this deep aquifer. Although the USGS model predicts downward groundwater flow components in Aquifer A3 and Aquifer C across most of the study area, it is interesting to note that upward flow is predicted near northern-most JBLM areas between the LWD and PLW service areas (Figures 5 and 6). PGG expects that studies performed by JBLM will better define vertical hydraulic gradients between aquifers near areas of PFAS contamination on the base, and whether such vertical gradients have locally caused PFAS migration to deeper aquifers.

As noted in Section 4.2, the regional formulation of the USGS model may not represent local discontinuities and variations in aquifer occurrence. Local-scale investigations may also reveal more complexity than represented in the USGS model and may shed more light on local groundwater flow directions and associated contaminant pathways.

6.3 TIME-SERIES TREND ANALYSES

The project was intended to use available data to describe current levels of PFAS contamination and time-series trends for sampled wells. However, time-series trends and any associated future projections are limited because multiple sites have only one sample event and none have more than five (**Table 2**). Available data show sampling events that range from 2017 to 2020.

PGG's time-series analysis was performed on combined PFOS+PFOA concentrations. Figure 3 illustrates the PFOS+PFOA concentrations over time at sample locations with two or more sampling events. Most of the graphed wells do not exhibit notable rising or falling trends, particularly relative to observed sample-to-sample variability (noise). Data from several of the wells plotted suggest rising trends; however, sometimes variability exceeds the inferred increase.

Sampled District Well J-1 and U-1 do not show much variation between sample events and values are low (between 0.02 and 0.04 ug/L as shown on **Figure 3**, which equals 20 to 70 ppt). Compare this to the DuPont HH Well 2 and BH Well 1 where values are higher and more variable. One well (LWD-G-2) shows an increasing trend that crossed the HAL, but this trend is based on only two sampling events. Additional sampling at all wells is needed before further time-series analysis is possible.

In anticipation of future rulemaking by DOH, PGG also plotted available data for the five PFAS constituent chemicals anticipated to be part of the future SALs (**Appendix C**). **Figures C1 through C5** illustrate time-series trends relative to both the current HAL and the proposed SAL. **Figures C6 and C7** are also included to show time-series trends for two additional constituents where data were sufficient to plot more than two reported values per well (these constituents are not currently targeted by EPA or DOH regulation). As with the PFOS+PFOA evaluation, most wells do not show rising trends, and the few that do are based on too few sampling events to make a strong interpretation. More notably,

five wells have PFOS or PFOA concentrations that exceed the proposed SAL (LWD-G-2, LWD-U-2, LWD-J-1, DPT-HH-Well1, DPT-HH-Well2), and several additional wells show concentration just below the SAL.

6.4 POTENTIAL PURVEYOR AND ECOLOGY CONCERNS

A primary concern is the regulatory level (change from HAL to SAL). While most detections are below the HAL, the number of wells exceeding guidance or regulatory limits would increase under the proposed SAL's. Once DOH has completed its rulemaking, the final SAL selected will govern the response by purveyors. Based on currently proposed SAL's, five of the sampled wells may have regulatory exceedances.

Several wells with possible increasing PFOA+PFOS concentration trends only have two sampling events, making it impossible to differentiate between variation (noise) and true increases. Additional sampling is required to assess whether noted wells are facing the threat of increasing concentrations.

While outside this scope-of-work, a basic question to be answered is whether the detection frequency among sampled wells is similar to or higher relative to other statewide datasets (particularly for areas with comparable land-use or development). Detections noted in this study largely occur in wells interpreted to be downgradient of JBLM, where PFAS contamination has been confirmed. Along with considering the potential for PFAS migration originating at the base, it would be worthwhile to investigate whether other local sources of PFAS contamination may exist.

7.0 RECOMMENDATIONS

This report represents a "snapshot" of 2017-2020 data reviewed under the Ecology grant. Additional sampling and interpretation are ongoing and should be incorporated, and the project database (and/or Ecology EIM) should be updated as new data become available. For example, the City of Tacoma has reported PFAS occurrence in one of its sources north of the District and intends to investigate the possible sources of contamination. Laboratory reports from past and future sampling at JBLM drinking water wells should be collected and included into the database.

The data collected by this initial effort represents a starting point for time-series monitoring of PFAS contamination in the study wells. However, as noted above, the number and frequency of sample data collected limit the ability to conduct analyses and establish meaningful trends. The level of risk for future contamination (i.e. rising contamination levels that would force a source well to require treatment for continued use) cannot be predicted with the current information. A regular sampling program is recommended that prioritizes wells with rising trends or regulatory exceedances, then wells with detections below guidelines or regulatory limits, then wells without detections but interpreted to be downgradient of known sources. Upcoming DOH rulemaking is also expected to require further monitoring by purveyors.

For further context, it would also be useful to compare the range of values in the database to other datasets collected across the state, especially in areas of similar levels or types of

development. Collection of comparable data from DOH records is suggested to help understand if the values found in this study are higher-than or similar-to other locations and the statewide

Identification of specific sources of PFAS contamination in the soil and their relationship to concentrations in groundwater provides important context for interpretation of the PFAS detections in study wells. This understanding will allow more specific investigation of travel pathways in the aquifers. Direct comparison and interpretation of PFAS occurrence at JBLM and downgradient locations is recommended based on sampling at multiple locations and over multiple aquifers along suspected flow directions. Improved understanding of transport of known contamination at JBLM to off-Base wells will have to await completion of JBLM's proposed remedial investigations and modeling, so continued interaction and communication with the JBLM is recommended. Potential sources of PFAS contamination between the Base and downgradient wells should also be considered.

Complex hydrogeologic conditions in the study area complicates the tracking of contamination flow paths. Groundwater flow models provide useful tools to understand future contamination risks to the extent that they represent the hydrogeologic conditions that control contaminant transport. However, JBLM has not yet completed studies characterizing the locations and concentrations of contamination on the Base or development of their anticipated predictive model. The USGS numerical groundwater model of the basin is currently being revised, with the new version expected to provide improved understanding of surface-water/groundwater interactions and flow relationships between the aquifers (needed to assess contamination risk to deeper aquifers). PGG recommends that the revised USGS model be referenced and/or adopted for predictive modeling of contaminant transport, but also notes that its regional scale may not fully capture local variation in hydrogeologic conditions. Completion of the USGS model effort is anticipated for mid-2021.

8.0 REFERENCES

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APPENDIX A
REPORT TABLES 1 THROUGH 4 AND FIGURES 1 THROUGH 7

Table 1: Hydrogeologic Units

Unit Name	USGS Geologic Unit Description	Study Wells in Unit	PFAS Detections?
A1 aquifer	Vashon Drift (Steilacoom gravel, recessional outwash)	Parkland Wells 7 and 9	Yes
A2 confining unit	Vashon Drift (till, moraine, recessional ice-contact, and lacustrine deposits)	None	--
A3 aquifer	Vashon Drift (advance outwash)	Lakewood Wells: G-1, G-2, H-1, H-2, J-1, J-3, and L-2 TPUD Wells: Crescent Park, Easter Day, Roy Water Co., Spanaway 192nd, Travis Jack, and Wilderness Glen	Yes
B confining unit	Olympia Beds (Kitsap Formation), Lawton Clay	None	--
C aquifer	Salmon Springs Drift, Penultimate Drift, Hayden Creek Drift, Wingate Hill Drift	DuPont Wells: BH Wells 1 and 3, HH Well 2 Lakewood Wells: D-3, E-3, U-1 Parkland Wells: 2, 3, 5, 6, and 12 TPUD Wells: Terry Lane	Yes
D confining unit	Puyallup Formation	None	--
E aquifer	Stuck Drift	DuPont Wells: BH Well 2, HH Well 1 Lakewood Wells: F-2, P-2, R-1 Parkland Wells: 1, 8, 13A, 14	No
F confining unit	Alderton Formation	None	--
G aquifer	Orting Drift and older deposits	None	No

Note: hydrogeologic unit nomenclature after Welch and Others, 2015.

Table 2. Well Construction Details

Well	Water System	Ecology UWID	Well Install Date	Well Depth (ft bgs)	Well Diameter (in)	Completion Aquifer	Depth to Top of Open Interval (ft bgs)	Depth to Bottom of Open Interval (ft bgs)
DPT-BH-Well1	DUPONT WATER SYSTEM, CITY OF	CAN722	8/16/1988	297	16	C	248	293
DPT-BH-Well2	DUPONT WATER SYSTEM, CITY OF	CAN756	10/26/1990	508	16	E		
DPT-BH-Well3	DUPONT WATER SYSTEM, CITY OF	AEF217	7/2/1998	266	20	C	197	261
DPT-HH-Well1	DUPONT WATER SYSTEM, CITY OF	AAD989	1/20/1998	497	16	E	417	490
DPT-HH-Well2	DUPONT WATER SYSTEM, CITY OF	AHM258	9/30/2003	375	16	C	295	355
LWD-D-3-Well	LAKEWOOD WATER DISTRICT	ACY107	12/24/1959	224	16	C	199.5	224
LWD-D-3-Well-CFW	LAKEWOOD WATER DISTRICT	ACY107	12/24/1959	224	16	C	199.5	224
LWD-E-3-Well	LAKEWOOD WATER DISTRICT		8/1/1977	271	16	C	211.7	263.9
LWD-F-2-Well	LAKEWOOD WATER DISTRICT	ACY133	4/1/1965	535	16	E	480	535
LWD-G-1-ScottsWell	LAKEWOOD WATER DISTRICT		6/15/1950	173	24	A3	153	173
LWD-G-2-Well	LAKEWOOD WATER DISTRICT		11/12/1960	180	16	A3	154	180
LWD-H-1-PondersWell	LAKEWOOD WATER DISTRICT	ACN740	3/15/1957	108	24	A3	85.4	106
LWD-H-2-Well	LAKEWOOD WATER DISTRICT		8/31/1959	105	16	A3	86	105
LWD-J-1-Well	LAKEWOOD WATER DISTRICT		2/25/1952	156	18	A3	135	156
LWD-J-3-Well	LAKEWOOD WATER DISTRICT	AEC947	12/4/2007	180	16	A3	140	160
LWD-L-2-Well	LAKEWOOD WATER DISTRICT	AEA457	5/9/1961	213	20	A3	182	213
LWD-P-2-Well	LAKEWOOD WATER DISTRICT	ACN752	3/13/1969	488	16	E	459.6	488
LWD-R-1-Well	LAKEWOOD WATER DISTRICT		10/12/1985	565	16	E	494.6	551.6
LWD-U-1-Well	LAKEWOOD WATER DISTRICT	AFK806	2/4/1996	302	16	C	199.7	293
PLW-Well-1	PARKLAND LIGHT & WATER COMPANY	ACW449		215	16	E		
PLW-Well-12	PARKLAND LIGHT & WATER COMPANY	ACN719	11/18/1978	390	16	C	343	388
PLW-Well-13A	PARKLAND LIGHT & WATER COMPANY	ABE846	7/18/1997	520	12	E	350.5	457.5
PLW-Well-14	PARKLAND LIGHT & WATER COMPANY	AEC933	9/26/2003	480	12	E	345	460
PLW-Well-2	PARKLAND LIGHT & WATER COMPANY	AEA453		366		C		
PLW-Well-3	PARKLAND LIGHT & WATER COMPANY	ACN749	4/21/1950	230	24	C	155	175
PLW-Well-5	PARKLAND LIGHT & WATER COMPANY	ACN720	4/7/1956	175	24	C	160	175
PLW-Well-6	PARKLAND LIGHT & WATER COMPANY	ACY102	12/1/1958	270	8	C		
PLW-Well-7	PARKLAND LIGHT & WATER COMPANY	ACY101	10/14/1963	30	12	A1	25	30.5
PLW-Well-8	PARKLAND LIGHT & WATER COMPANY	ACN718	3/12/1964	625	16	E	603	625
PLW-Well-9	PARKLAND LIGHT & WATER COMPANY	ACN721	9/1/1963	31	20	A1	21	31
TPUD-CresPark-Well	CRESCENT PARK # 355	ACY124	2/20/1985	116	10	A3	110	116

Table 2. Well Construction Details

Well	Water System	Ecology UWID	Well Install Date	Well Depth (ft bgs)	Well Diameter (in)	Completion Aquifer	Depth to Top of Open Interval (ft bgs)	Depth to Bottom of Open Interval (ft bgs)
TPUD-EasterDay-Well	EASTER DAY - 271		12/10/1986	78	6	A3	78	78
TPUD-Roy-WellAAE122	ROY WATER CO INC	AAE122	3/27/1984	126	8	A3	116	121
TPUD-Spanaway-192-Well	SPANAWAY 192ND WATER SYSTEM	ACM782	10/21/1968	146	12	A3	116	146
TPUD-TerryLn-Well	TERRY LANE # 354	ACY125	1/15/1965	349	8	C	275	346
TPUD-TravJack-Well	TRAVIS JACK - 264	AEF408	8/29/1985	138	8	A3	138	138
TPUD-WildGlen-Well	WILDERNESS GLEN - 263	AEF409	9/17/1984	201	8	A3	193	198

bgs = below ground surface
LWD-D-3-Well-CFW = Chlor(am)inated Fishished Water collected from LWD-D-3-Well

Table 3. Number of PFAS Analyses by Constituent and Purveyor Well

	EPA HAL Est. & Draft WDOH SAL Proposed for Parameter		*Draft WDOH SAL Proposed for Parameter*											
Well	**Perfluorooctanesulfonic acid (PFOS)**	**Perfluorooctanoic acid (PFOA)**	**Perfluorobutanesulfonic acid (PFBS)**	**Perfluorohexanesulfonic acid (PFHxS)**	**Perfluorononanoic acid (PFNA)**	**Perfluoroheptanoic acid (PFHpA)**	**Perfluorohexanoic acid (PFHxA)**	**N-ethyl Perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)**	**N-methyl Perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)**	**Perfluorodecanoic acid (PFDA)**	**Perfluorododecanoic acid (PFDoA)**	**Perfluorotetradecanoic acid (PFTeA)**	**Perfluorotridecanoic acid (PFTriA)**	**Perfluoroundecanoic acid (PFUnA)**
DPT-BH-Well1	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
DPT-BH-Well2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
DPT-BH-Well3	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
DPT-HH-Well1	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
DPT-HH-Well2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
LWD-D-3-Well	1	1	1	1	1	1								
LWD-D-3-Well-CFW	1	1	1	1	1	1								
LWD-E-3-Well	1	1	1	1	1	1								
LWD-F-2-Well	1	1	1	1	1	1								
LWD-G-1-ScottsWell	**4**	**4**	**4**	**4**	**4**	**4**								
LWD-G-2-Well	**2**	**3**	**3**	**2**	**3**	**3**								
LWD-H-1-PondersWell	1	1	1	1	1	1								
LWD-H-2-Well	1	1	1	1	1	1								
LWD-J-1-Well	**2**	**2**	**2**	**2**	**2**	**2**								
LWD-J-3-Well	1	1	1	1	1	1								
LWD-L-2-Well	1	1	1	1	1	1								
LWD-P-2-Well	1	1	1	1	1	1								
LWD-R-1-Well	**2**	**2**	**2**	**2**	**2**	**2**								
LWD-U-1-Well	**3**	**3**	**3**	**3**	**3**	**3**								
PLW-Well-1	1	1	1	1	1	1								
PLW-Well-12	1	1	1	1	1	1								
PLW-Well-13A	1	1	1	1	1	1								
PLW-Well-14	1	1	1	1	1	1								
PLW-Well-2	1	1	1	1	1	1								
PLW-Well-3	1	1	1	1	1	1								
PLW-Well-5	1	1	1	1	1	1								
PLW-Well-6	1	1	1	1	1	1								
PLW-Well-7	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
PLW-Well-8	1	1	1	1	1	1								
PLW-Well-9	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
TPUD-CresPark-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-EasterDay-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-Roy-WellAAE122	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-Spanaway-192-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-TerryLn-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-TravJack-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPUD-WildGlen-Well	1	1	1	1	1	1	1	1	1	1	1	1	1	1

EPA HAL = EPA Health Advisory Limit

WDOH SAL = WDOH State Action Limit

Bold = Parameter analyzed more than once

White PFAS Name = Parameter not detected in any sample in current data set

DPT = City of Dupont; LWD = Lakewood Water District; PLW = Parkland Light and Water Company; TPUD = Thurston Public Utility District

LWD-D-3-Well-CFW = Chlor(am)inated Fishished Water collected from LWD-D-3-Well

Table 4. PFAS Groundwater Analytical Summary

Well	Sample Date/Time	Units	EPA HAL for PFOS + PFOA	Sum of PFOS and PFOA [1]	PFOS	PFOA	PFBS	PFHxS	PFNA	PFHpA	PFHxA	N-EtFOSAA	N-MeFOSAA	PFDA	PFDoA	PFTeA	PFTriA	PFUnA
DPT-BH-Well1	4/9/2019 11:40	ug/L	0.07	0.009	0.0021	0.0069	0.002 U	0.0069	0.002 U	0.002 U	0.0023	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well1	6/18/2019 10:55	ug/L	0.07	0.0113	0.0036	0.0077	0.002 U	0.0056	0.002 U	0.002 U	0.0024	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well1	8/21/2019 10:05	ug/L	0.07	0.0134	0.0034	0.01	0.002 U	0.0059	0.002 U	0.002 U	0.0028	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well1	10/21/2019 11:44	ug/L	0.07	0.0126	0.0042	0.0084	0.002 U	0.0066	0.002 U	0.002 U	0.0031	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well1	4/7/2020 9:55	ug/L	0.07	0.0128	0.0043	0.0085	0.002 U	0.007	0.002 U	0.002 U	0.0027	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well2	6/18/2019 10:45	ug/L	0.07	0.002	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well2	8/21/2019 10:10	ug/L	0.07	0.002	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well2	10/21/2019 11:48	ug/L	0.07	0.002	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well3	4/9/2019 11:40	ug/L	0.07	0.0113	0.0042	0.0071	0.002 U	0.006	0.002 U	0.002 U	0.0022	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well3	6/18/2019 10:50	ug/L	0.07	0.0115	0.0038	0.0077	0.002 U	0.0057	0.002 U	0.002 U	0.0029	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well3	8/21/2019 10:15	ug/L	0.07	0.0143	0.0033	0.011	0.002 U	0.0059	0.002 U	0.002 U	0.0025	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well3	10/21/2019 11:50	ug/L	0.07	0.0128	0.0044	0.0084	0.002 U	0.0056	0.002 U	0.002 U	0.0023	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-BH-Well3	4/7/2020 10:00	ug/L	0.07	0.0124	0.0041	0.0083	0.002 U	0.0057	0.002 U	0.002 U	0.0024	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well1	4/9/2019 9:30	ug/L	0.07	0.053	0.01	0.043	0.0043	0.022	0.002 U	0.0041	0.013	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well1	6/18/2019 14:20	ug/L	0.07	0.056	0.011	0.045	0.0044	0.022	0.002 U	0.0041	0.013	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well1	8/21/2019 11:15	ug/L	0.07	0.068	0.01	0.058	0.0037	0.024	0.002 U	0.0045	0.012	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well1	10/21/2019 14:55	ug/L	0.07	0.06	0.01	0.05	0.0044	0.022	0.002 U	0.0041	0.014	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well2	4/9/2019 10:10	ug/L	0.07	0.04	0.014	0.026	0.0041	0.02	0.002 U	0.0037	0.0097	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well2	8/21/2019 10:50	ug/L	0.07	0.046	0.012	0.034	0.0035	0.02	0.002 U	0.0045	0.0091	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
DPT-HH-Well2	10/21/2019 14:05	ug/L	0.07	0.041	0.014	0.027	0.0042	0.02	0.002 U	0.0036	0.0093	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
LWD-D-3-Well	6/26/2017 9:30	ug/L	0.07	0.00395	0.0027	0.0025 U	0.0025 U	0.0029	0.0025 U	0.0025 U								
LWD-D-3-Well-CFW	5/1/2018 10:00	ug/L	0.07	0.0076	0.005	0.0026	0.0025 U	0.0052	0.0025 U	0.0025 U								
LWD-E-3-Well	5/1/2018 14:00	ug/L	0.07	0.0159	0.0094	0.0065	0.0051	0.011	0.005	0.0025 U								
LWD-F-2-Well	5/1/2018 8:00	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
LWD-G-1-ScottsWell	6/27/2017 9:00	ug/L	0.07	0.047	0.042	0.005	0.0073	0.032	0.0025 U	0.0025 U								
LWD-G-1-ScottsWell	10/4/2018 10:30	ug/L	0.07	0.0292	0.024	0.0052	0.0069	0.022	0.002 U	0.0021								
LWD-G-1-ScottsWell	2/25/2019 10:34	ug/L	0.07	0.0232	0.018	0.0052	0.0069	0.023	0.002 U	0.0023								
LWD-G-1-ScottsWell	7/24/2019 9:30	ug/L	0.07	0.0618	0.054	0.0078	0.01	0.039	0.002 U	0.0036								
LWD-G-2-Well	5/1/2018 9:15	ug/L	0.07	0.0389	0.033	0.0059	0.0093	0.031	0.0025 U	0.0027								
LWD-G-2-Well	2/25/2019 10:31	ug/L	0.07	**0.0771**	0.069	0.0081	0.012	0.05	0.002 U	0.004								
LWD-G-2-Well	7/24/2019 10:05	ug/L	0.07	0.015		0.015	0.015		0.002 U	0.0066								
LWD-H-1-PondersWell	6/26/2017 11:40	ug/L	0.07	0.046	0.038	0.008	0.0075	0.021	0.0025 U	0.0039								
LWD-H-2-Well	5/1/2018 9:35	ug/L	0.07	0.063	0.052	0.011	0.011	0.026	0.0025 U	0.006								
LWD-J-1-Well	5/1/2018 8:45	ug/L	0.07	0.0202	0.013	0.0072	0.0081	0.012	0.0025 U	0.0028								
LWD-J-1-Well	2/25/2019 11:12	ug/L	0.07	0.0195	0.012	0.0075	0.0087	0.012	0.002 U	0.0025								
LWD-J-3-Well	6/26/2017 13:00	ug/L	0.07	0.0174	0.012	0.0054	0.0062	0.01	0.003 U	0.003 U								
LWD-L-2-Well	5/1/2018 12:40	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025	0.0025 U	0.0025 U	0.0025 U								
LWD-P-2-Well	10/4/2018 11:45	ug/L	0.07	0.002	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U								

Table 4. PFAS Groundwater Analytical Summary

Well	Sample Date/Time	Units	EPA HAL for PFOS + PFOA	Sum of PFOS and PFOA [1]	PFOS	PFOA	PFBS	PFHxS	PFNA	PFHpA	PFHxA	N-EtFOSAA	N-MeFOSAA	PFDA	PFDoA	PFTeA	PFTriA	PFUnA
LWD-R-1-Well	6/26/2017 12:00	ug/L	0.07	0.003	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U								
LWD-R-1-Well	5/1/2018 7:40	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
LWD-U-1-Well	5/1/2018 8:20	ug/L	0.07	0.0331	0.029	0.0041	0.0057	0.021	0.0025 U	0.0025 U								
LWD-U-1-Well	2/25/2019 11:56	ug/L	0.07	0.0337	0.03	0.0037	0.0062	0.022	0.0026	0.002 U								
LWD-U-1-Well	7/24/2019 12:15	ug/L	0.07	0.0335	0.029	0.0045	0.0053	0.02	0.0031	0.002 U								
PLW-Well-1	11/29/2017 8:20	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-12	11/29/2017 9:05	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-13A	11/29/2017 7:55	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-14	11/29/2017 7:40	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-2	11/29/2017 13:00	ug/L	0.07	0.00735	0.0061	0.0025 U	0.0027	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-3	11/29/2017 10:50	ug/L	0.07	0.00905	0.0078	0.0025 U	0.0031	0.004	0.0025 U	0.0025 U								
PLW-Well-5	11/29/2017 13:05	ug/L	0.07	0.0138	0.011	0.0028	0.0039	0.0046	0.0025 U	0.0025 U								
PLW-Well-6	11/29/2017 8:45	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-7	6/18/2019 11:20	ug/L	0.07	0.0129	0.0072	0.0057	0.0057	0.0046	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
PLW-Well-7	1/21/2020 12:00	ug/L	0.07	0.02	0.014	0.006	0.0068	0.0076	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
PLW-Well-8	11/29/2017 10:20	ug/L	0.07	0.0025	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U								
PLW-Well-9	6/18/2019 11:40	ug/L	0.07	0.0133	0.0074	0.0059	0.0067	0.005	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
PLW-Well-9	1/21/2020 13:25	ug/L	0.07	0.0175	0.012	0.0055	0.0062	0.0066	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
TPUD-CresPark-Well	6/1/2020 9:45	ug/L	0.07	0.00439	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U	0.00439 U
TPUD-EasterDay-Well	6/1/2020 13:57	ug/L	0.07	0.03937	0.00877	0.0306	0.00287 J	0.0156	0.00424 U	0.00257 J	0.00834	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U
TPUD-Roy-WellAAE122	6/1/2020 12:45	ug/L	0.07	0.00424	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U	0.00424 U
TPUD-Spanaway-192-Well	6/1/2020 10:45	ug/L	0.07	0.00962	0.0059	0.00372 J	0.0041 J	0.00228 J	0.00431 U	0.00139 J	0.00278 J	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U
TPUD-TerryLn-Well	6/1/2020 10:07	ug/L	0.07	0.00421	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U	0.00421 U
TPUD-TravJack-Well	6/1/2020 11:33	ug/L	0.07	0.00431	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U	0.00431 U
TPUD-WildGlen-Well	6/1/2020 12:09	ug/L	0.07	0.00428	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U	0.00428 U

EPA HAL = EPA Health Advisory Limit

[1] Non-detect results represented as 1/2 lab reporting limit in calculation

LWD-D-3-Well-CFW = Chlor(am)inated Fishished Water collected from LWD-D-3-Well

U = constituent not detected, associated number is the lab reporting limit

J = estimated value

Bold = Sum of PFOS+PFOA exceeds EPA HAL

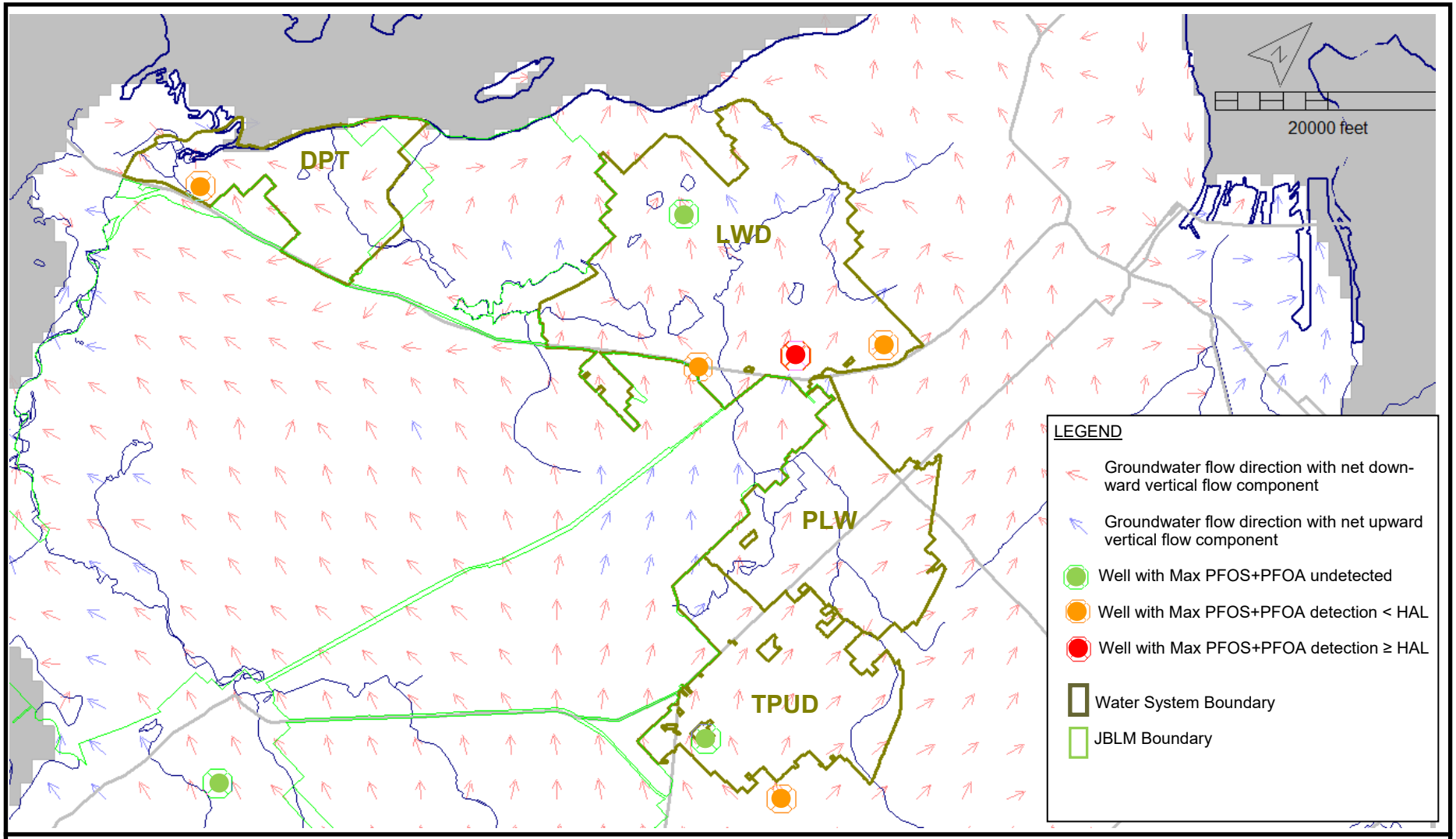


FIGURE 5
MODELED GROUNDWATER FLOW DIRECTIONS AND REFERENCED WELLS IN AQUIIFER A3

Groundwater PFAS Investigation
Lakewood Water District

PgG

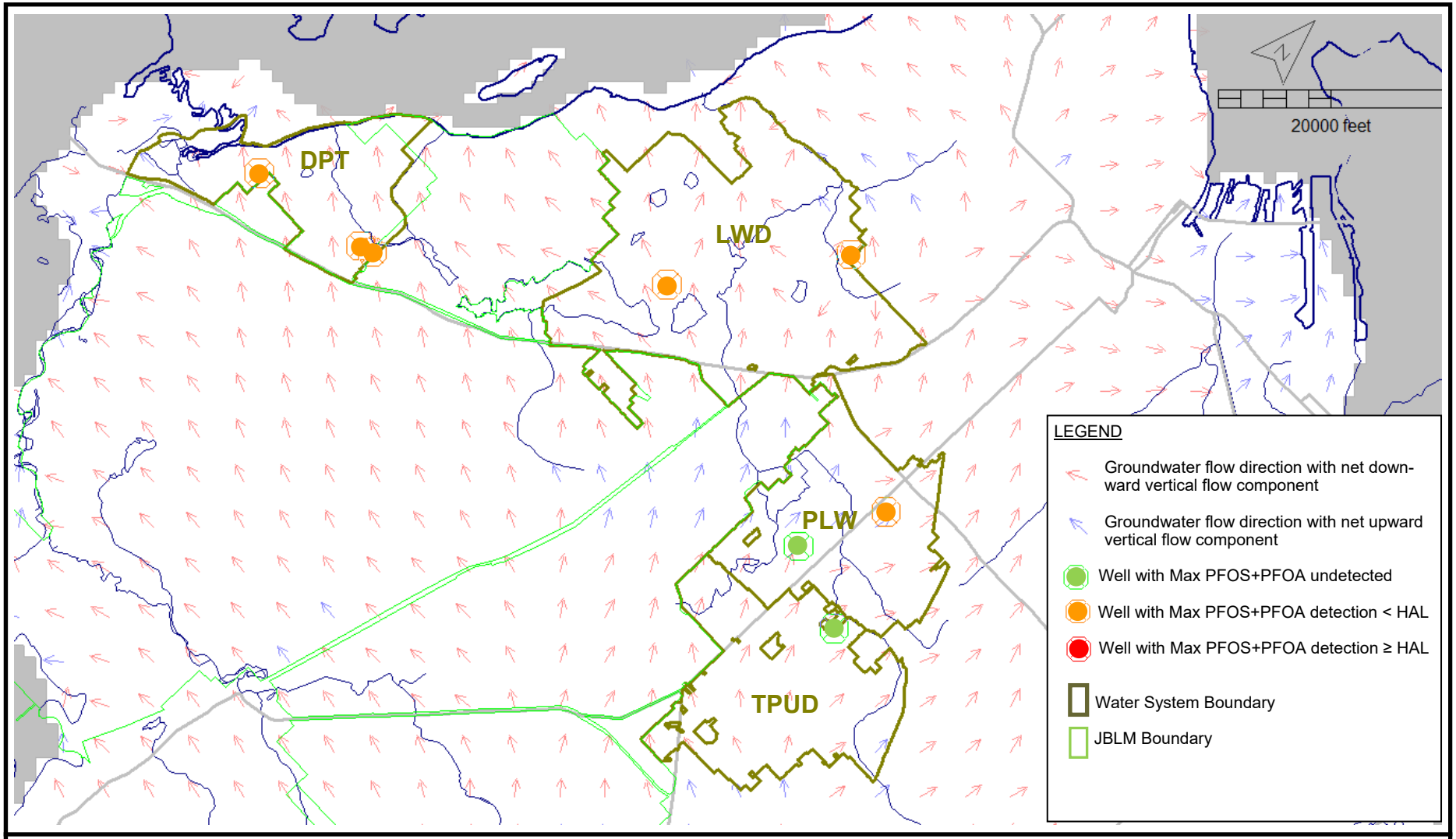


FIGURE 6
MODELED GROUNDWATER FLOW DIRECTIONS AND REFERENCED WELLS IN AQUIIFER C

Groundwater PFAS Investigation
Lakewood Water District

PgG

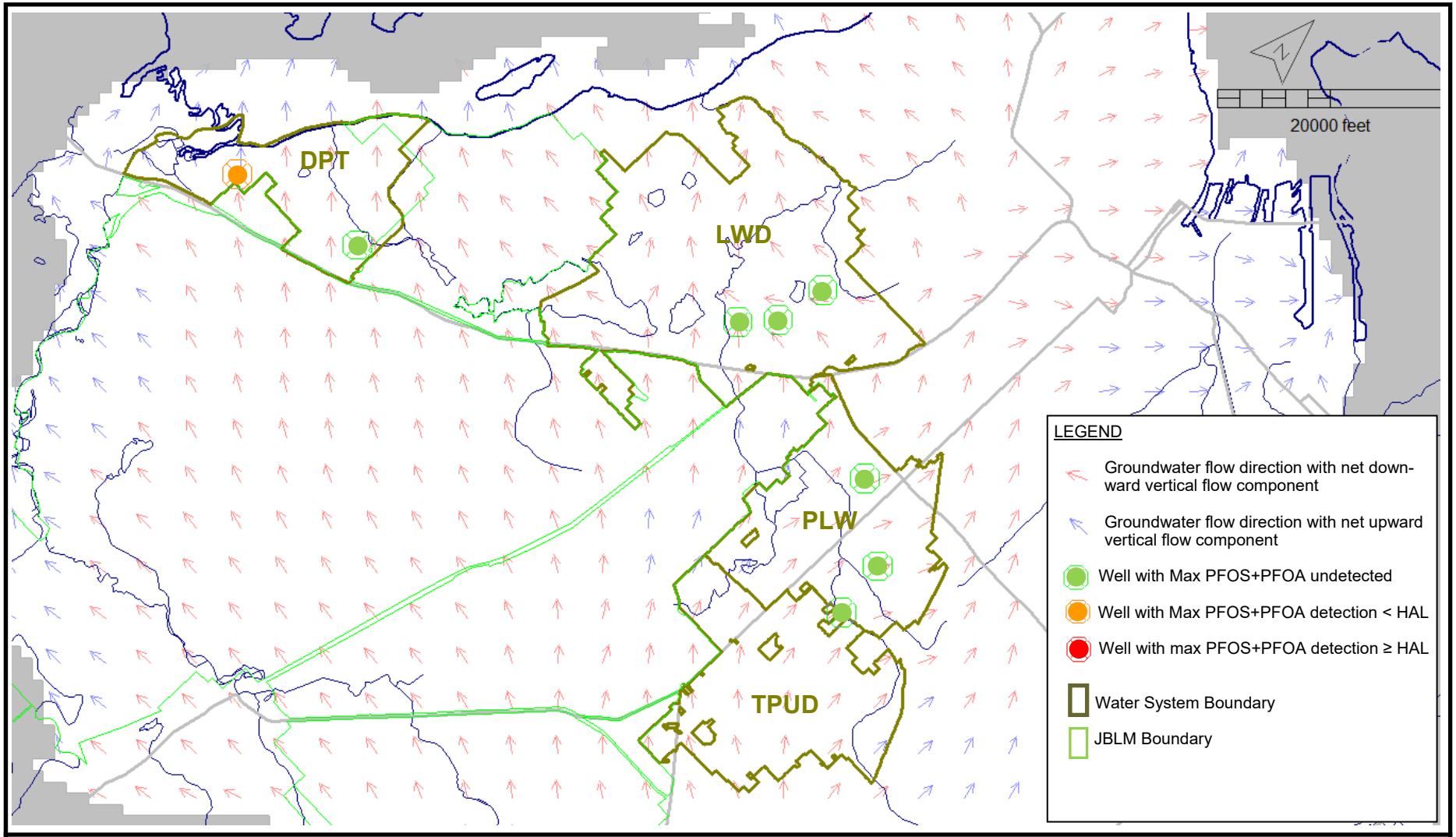


FIGURE 7
MODELED GROUNDWATER FLOW DIRECTIONS AND REFERENCED WELLS IN AQUIIFER E

Groundwater PFAS Investigation
Lakewood Water District

PgG

APPENDIX B
JBLM TPP 3 FIGURES

FIGURE B1

Joint Base Lewis-McChord, Washington
Public Works
Drinking Water Source Well PFOS + PFOA Results

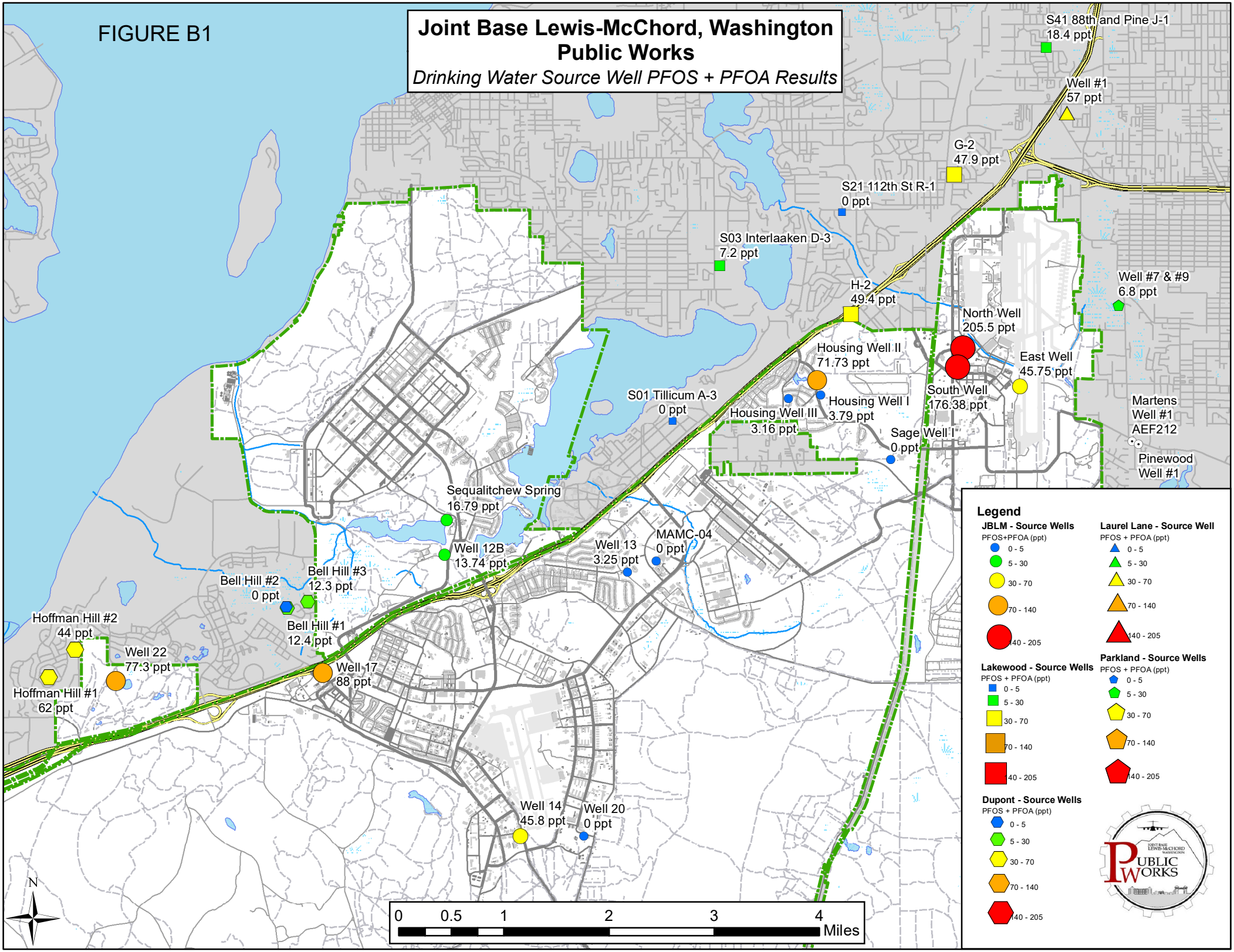


FIGURE B2

LT-4
33.8

1168-MW01
383

CW-62
114.81

CW-64
78.5

SW-1
35.69 (33.17)

CR-01
123

CW-4
1.46

MF-2
42.5

CW-15C
973.3

CW-29B
183

MF-1
618.2

CW-12
39.2

CW-15D
1.69 (1.71)

North Well

CW-14A
139.5

South Well

CW-14C
340

CW-14D
159.60 (159.90)

East Well

FTA-4A
22,089

FTA-4B
37,170

CW-33C
24

IH-3B
2,478

IH-3C
2,653
(2,585)

IH-1B
2.77

IH-1A
0

Housing Well II

Housing Well I

Housing Well III

DO-2
42.1

DO-5B
81

DA-21A
41.3

DA-7E
0

MARS HI

Sage Well II

Sage Well I

DA-4B
8.1

DA-4A
14.3

Replacement Well II

LF4-MW-10
13

LF4-PNL1
12.14

LF4-01
18.92

Sequalitchew Spring

S-Effluent
25.36

S-Influent
33.32

Well 12B

Well 12A

SLA-Effluent
14.76

SLA-Influent
16.39

MAMC-04

Well 13

LC-230
8.6

LC-153
0.73

LF-2-Effluent
0.95

LF-2-Influent
69.5

Well 10

Well 23

Well 22

Well 17

4131-MW04
61.30 (58.50)

01035-MW01
169.3

84-CD-LFI-1
4.17

84-CD-LFI-4
2.79

Well 14

Well 20

98-IA-MW08
20.9

Legend

Phase 1 Sampling Results - Vashon Aquifer
- <70ppt
- 70ppt - 200ppt
- 200ppt - 1,000ppt
- >1,000ppt

Phase 1 Sampling Results - Sea Level Aquifer
- <70ppt
- 70ppt - 200ppt

JBLM Production Wells ppt - Sum of PFOS and PFOA only
- 0 - 5
- 6 - 30
- 31 - 70
- 71 - 140
- 141 - 251

Monitoring Wells
- Existing Monitoring Wells
- Monitoring Wells Selected for Phase 1 Sampling
- Surface Water Sample Locations
- JBLM Boundary
- 10-Year WHPA/Capture Zones

CW-15D
1.69 (1.71)
Well ID
6 UCMR Compounds Summed Concentration (ng/L)*

*Concentration in Parenthesis Notes Duplicate Sample

N

0 0.25 0.5 1 Miles

Figure 10-8
Phase I Sample Results

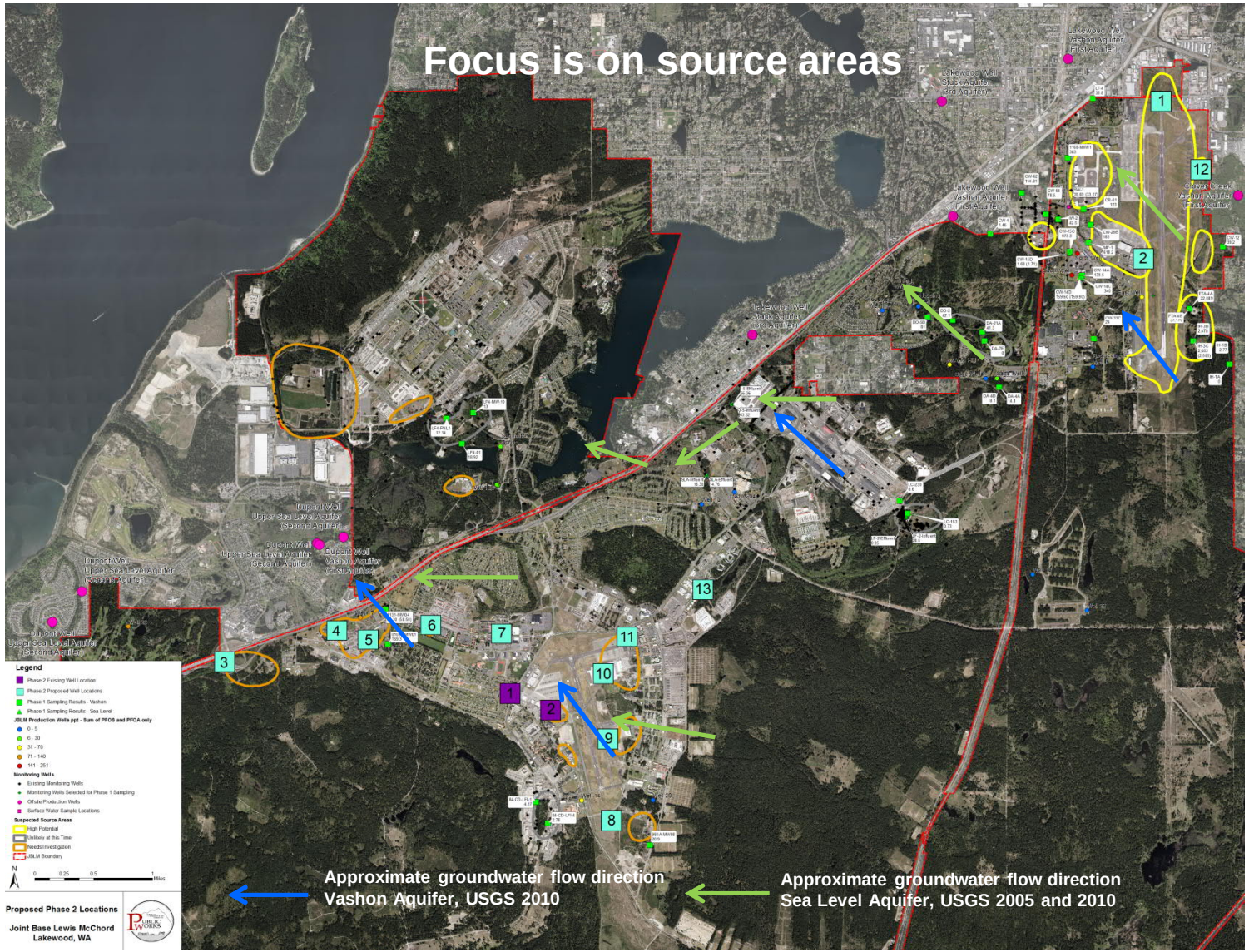
Joint Base Lewis McChord
Lakewood, WA

Document Path: J:\DCS\Projects\ENV\60555402 JBLM PASI\900-CAD-GIS\940-GIS\MXDs\Phase_1_Sampling_Results_v2.mxd

Aerial Sources: JBLM Public Works 2016_UTM10_NAD83_NAVD88.sid

FIGURE B3

Proposed Phase 2 Source Area Sampling Locations Overview



1

Proposed new well location

1

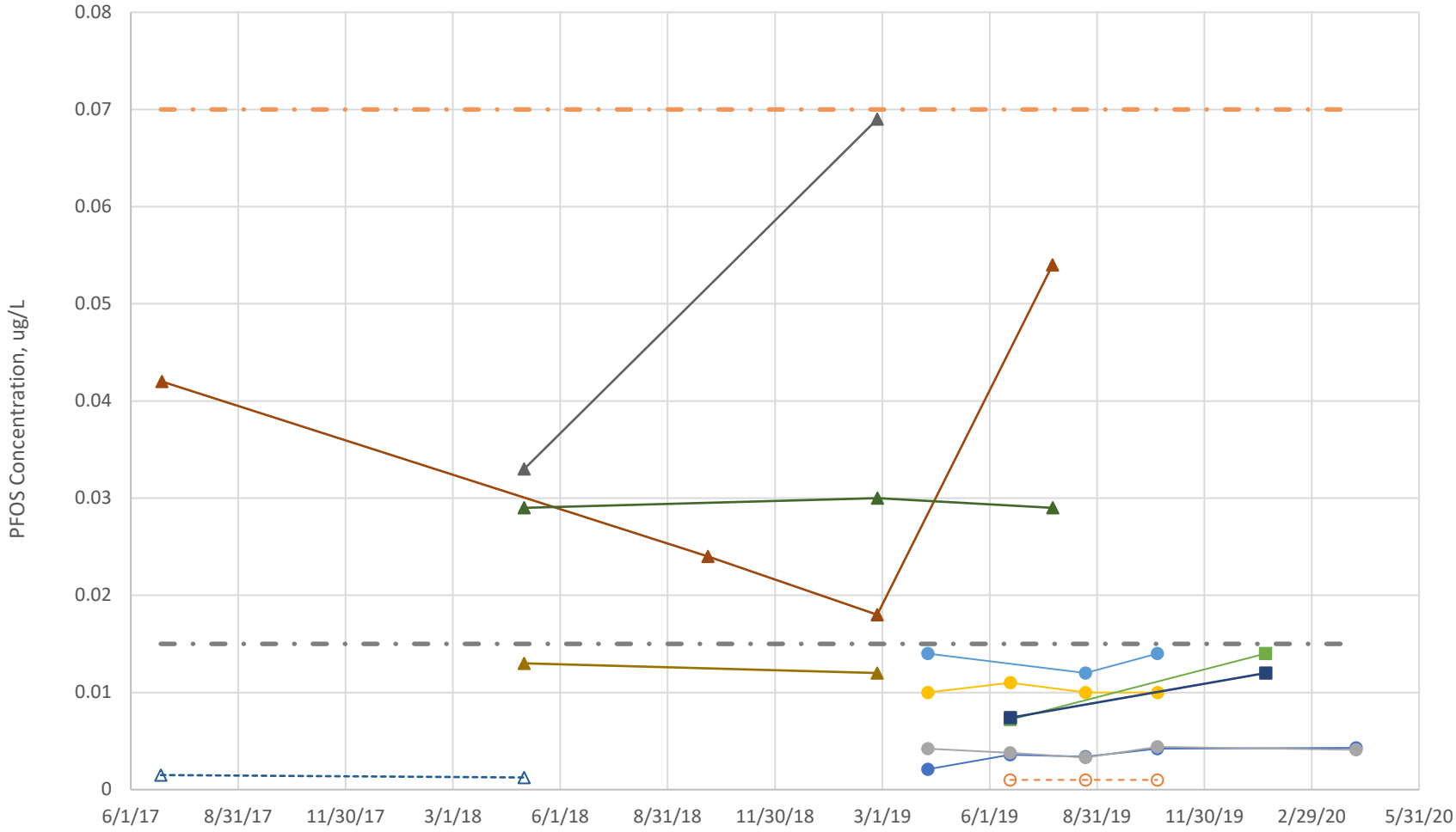
Proposed existing well location

Phase 2

Look at potential source areas that did not have sufficient existing well coverage

Following slides zoom into specific areas and show rationale

APPENDIX C
ADDITIONAL PFAS TIME-SERIES GRAPHS

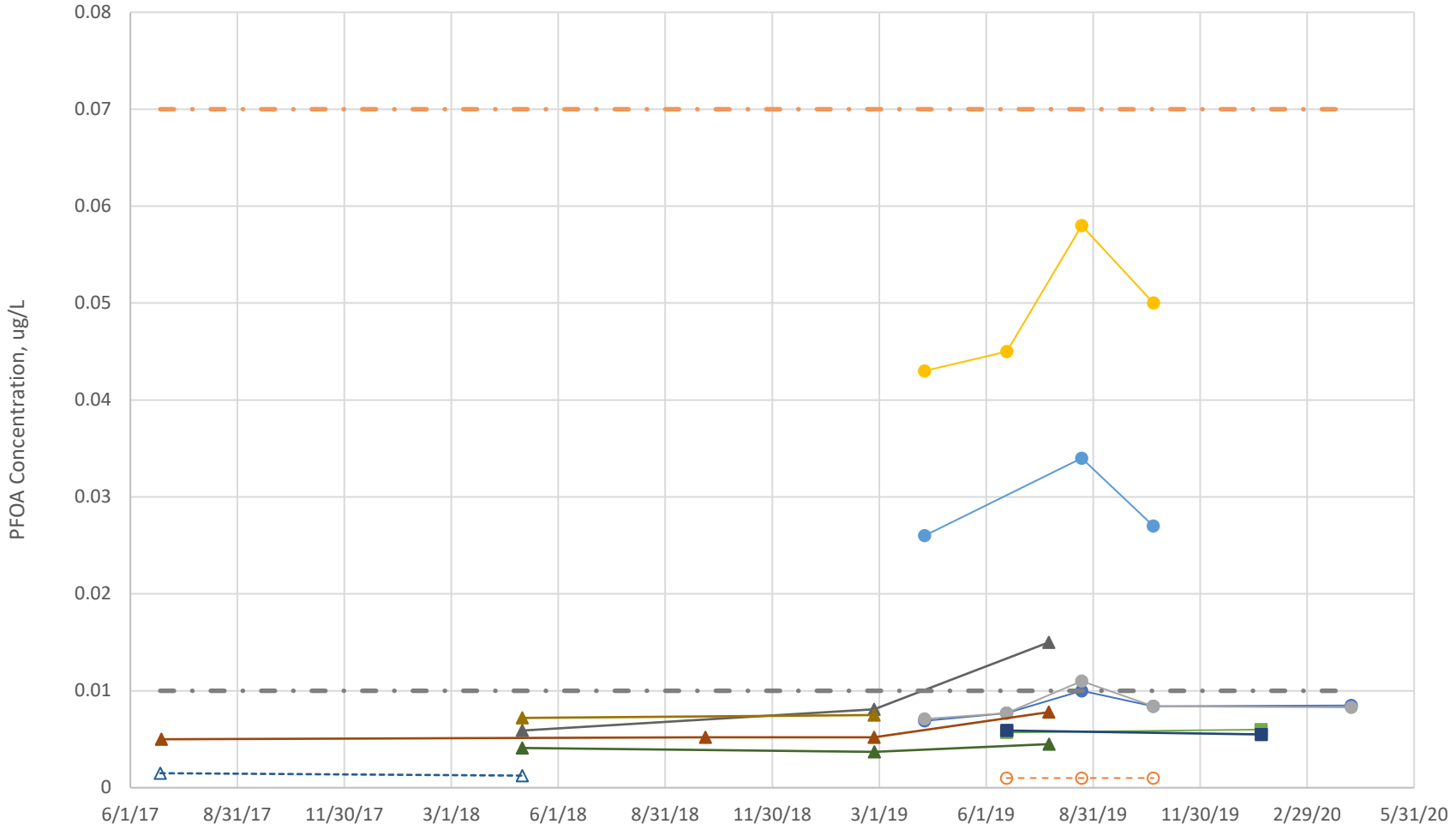


Non-detect values represented by 1/2 Reporting Limit. Hollow symbols with dashed lines are non-detect results, solid symbols with solid lines are detections.

Figure C1. Concentrations of Perfluorooctanesulfonic acid (PFOS) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

PgG



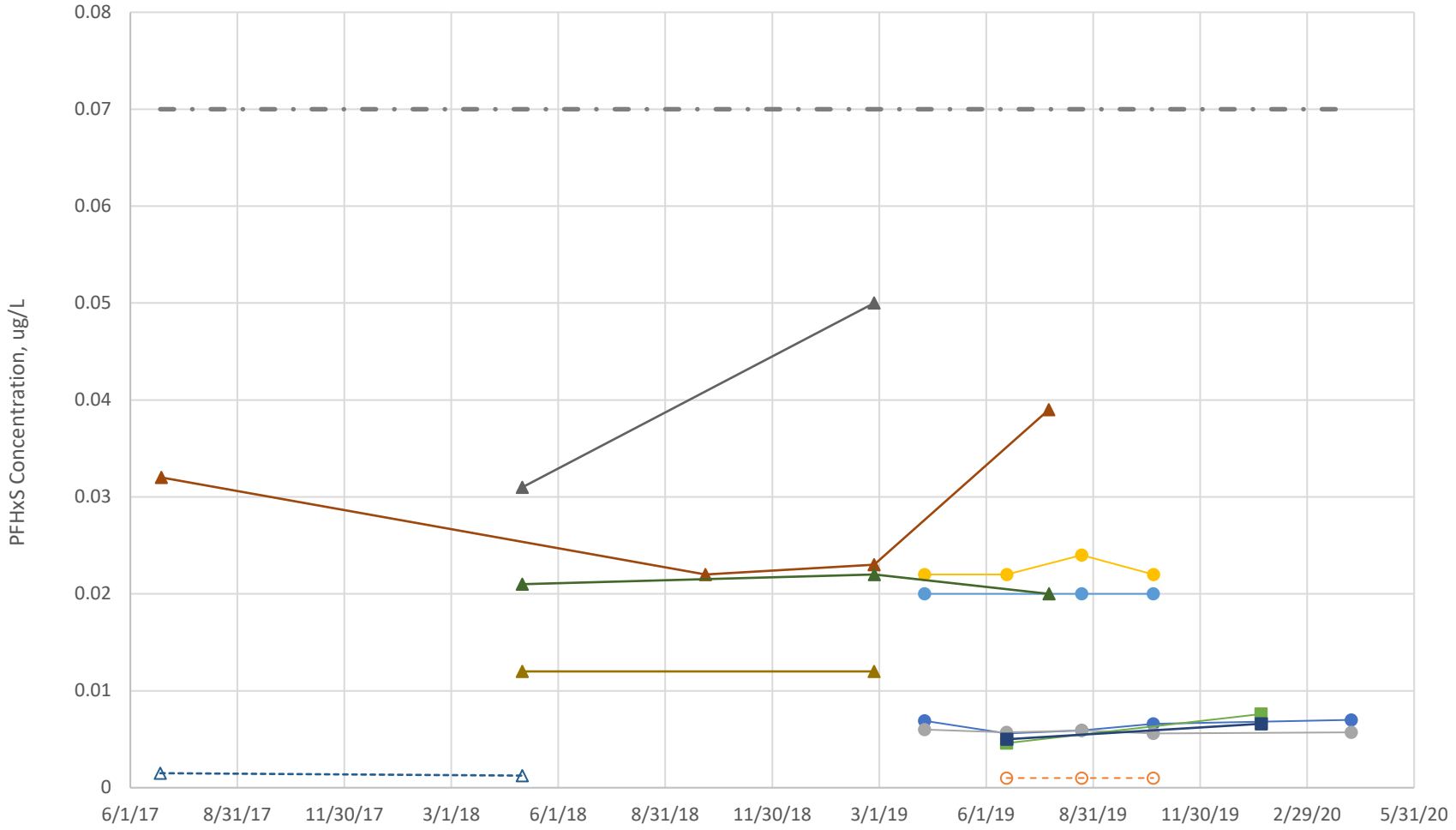
DPT-BH-Well1
DPT-BH-Well2
DPT-BH-Well3
DPT-HH-Well1
DPT-HH-Well2
PLW-Well-7
PLW-Well-9
LWD-G-1-ScottsWell
LWD-G-2-Well
LWD-J-1-Well
LWD-R-1-Well
LWD-U-1-Well
Proposed DOH SAL
EPA HAL (PFOA+PFOS)

Non-detect values represented by 1/2 Reporting Limit. Hollow symbols with dashed lines are non-detect results, solid symbols with solid lines are detections.

Figure C2. Concentrations of Perfluorooctanoic acid (PFOA) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

PgG

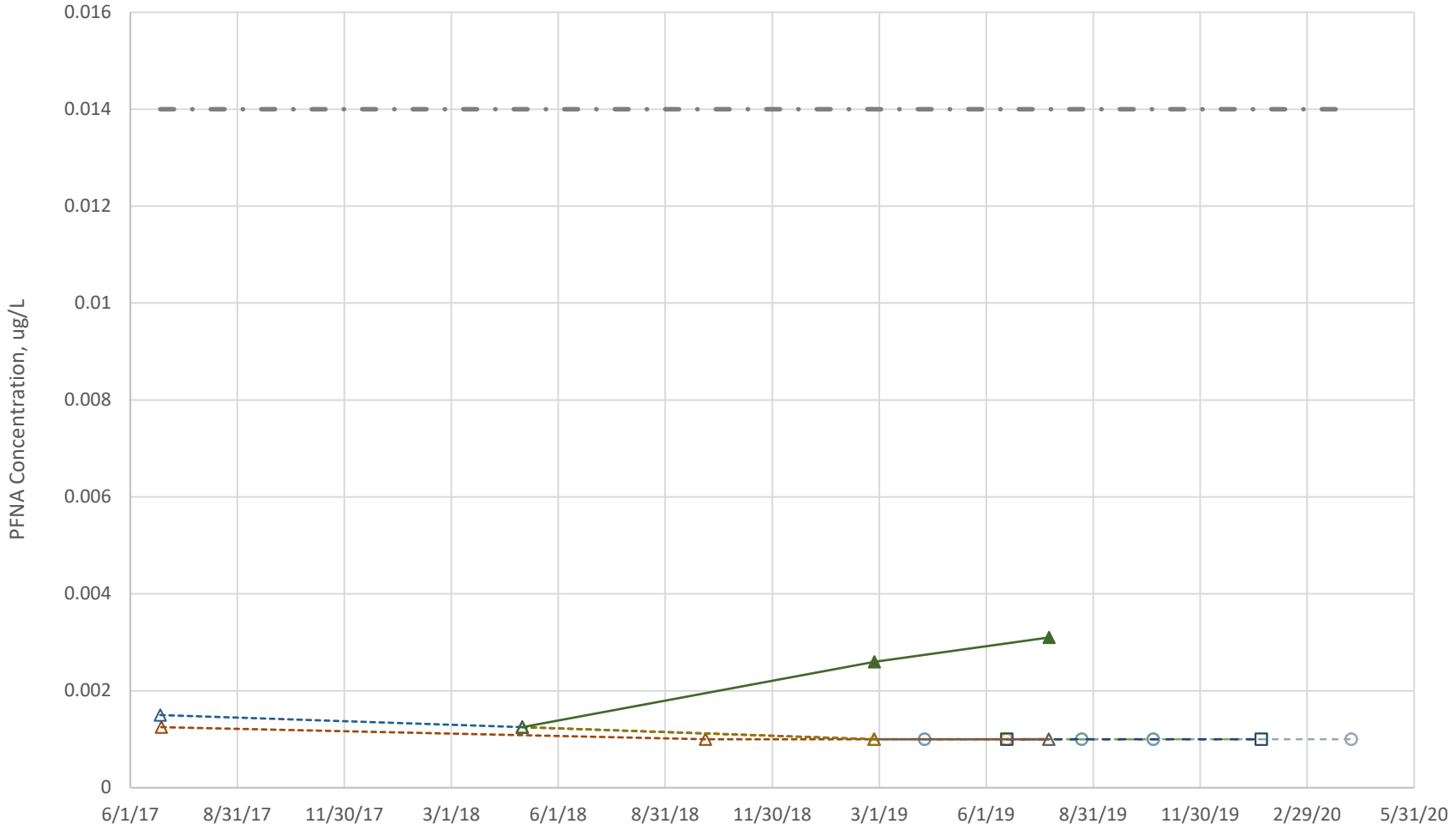


Non-detect values represented by 1/2 Reporting Limit. Hollow symbols with dashed lines are non-detect results, solid symbols with solid lines are detections.

Figure C3. Concentrations of Perfluorohexanesulfonic acid (PFHxS) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

PgG

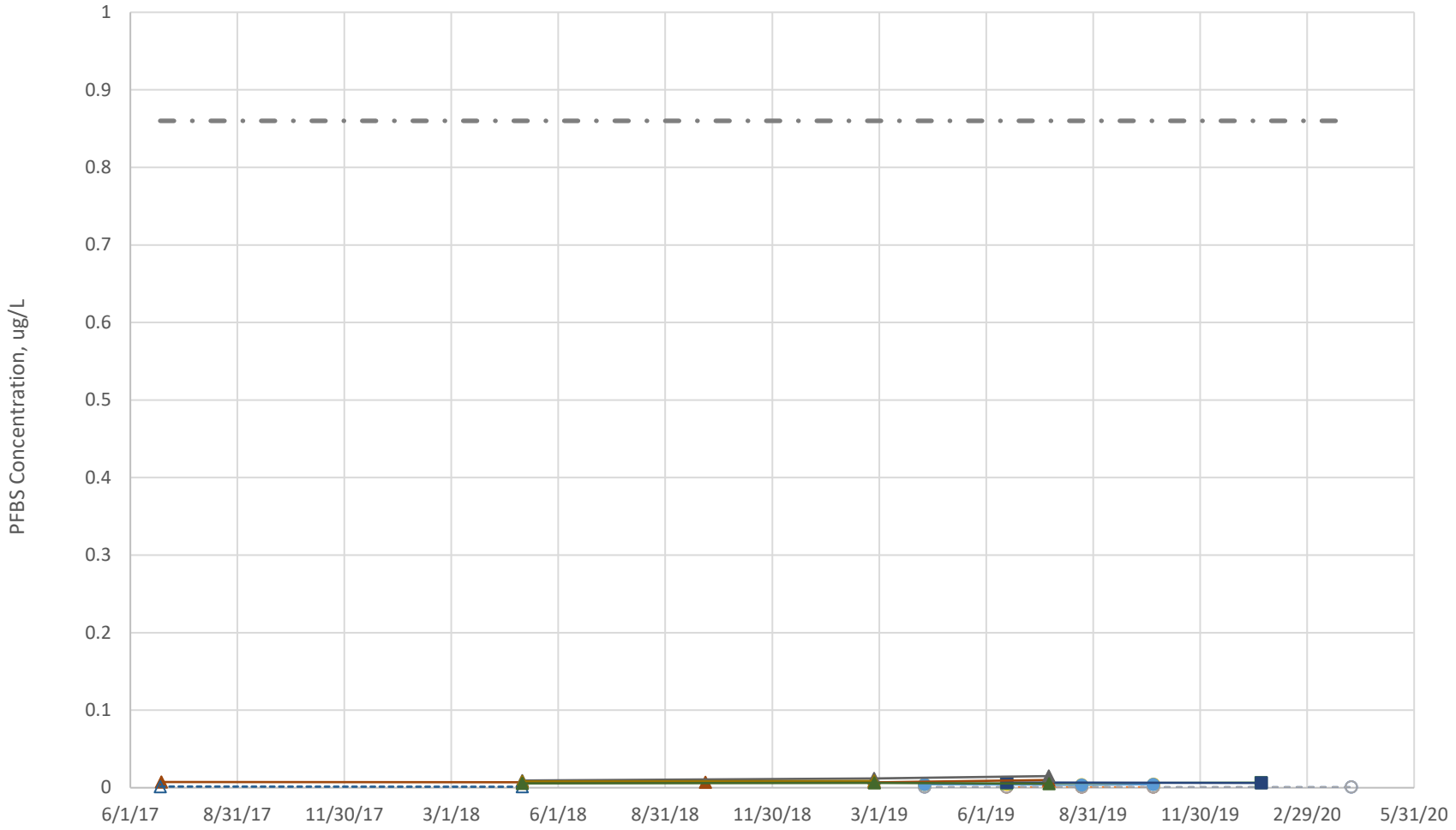


Non-detect values represented by 1/2 Reporting Limit. Hollow symbols/dashed lines are ND, solid symbols/solid lines are detections (note that LWD-U-1-Well has both non-detect results and detections).

Figure C4. Concentrations of Perfluorononanoic acid (PFNA) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

PgG



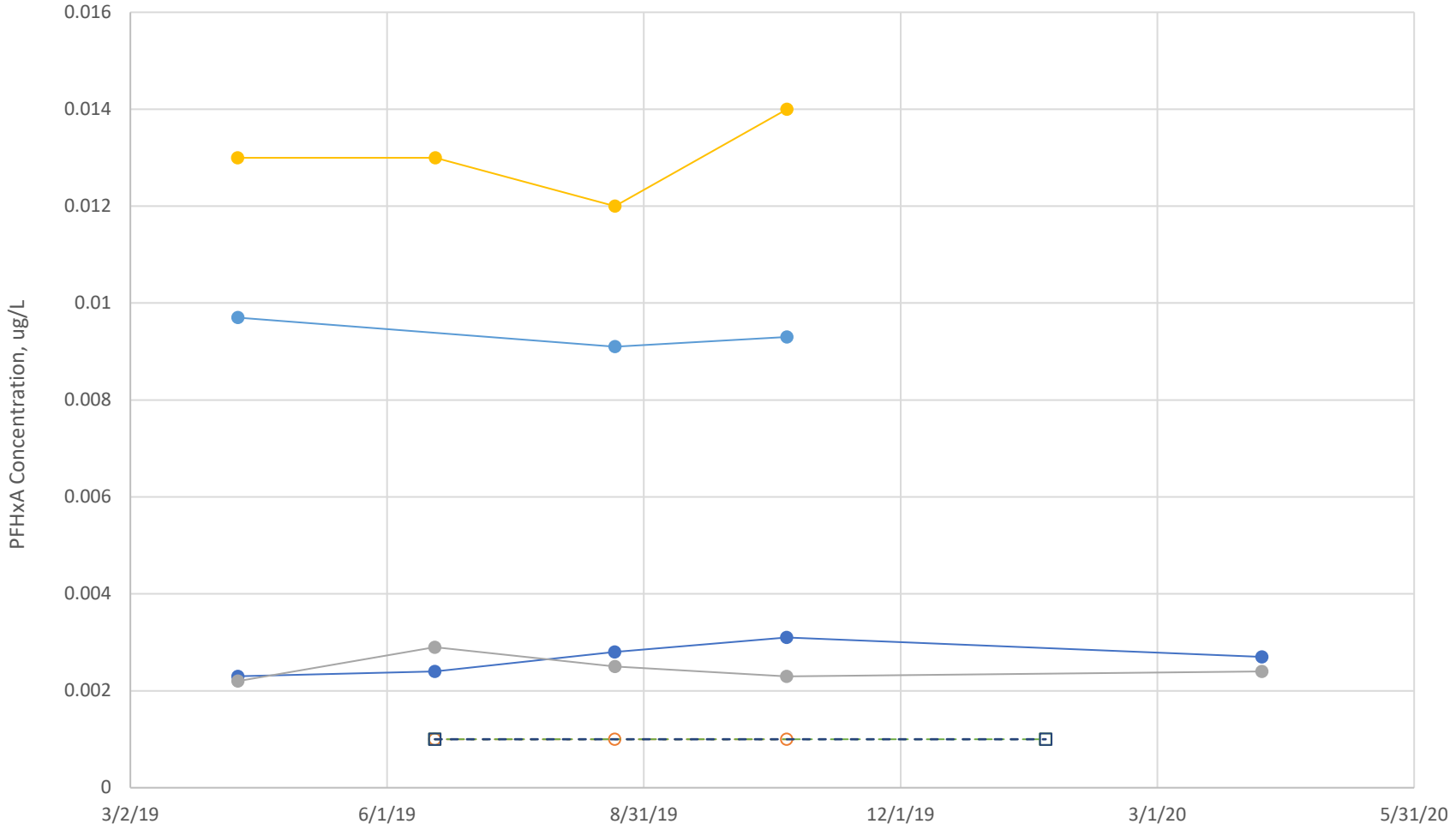
DPT-BH-Well1
DPT-BH-Well2
DPT-BH-Well3
DPT-HH-Well1
DPT-HH-Well2
PLW-Well-7
PLW-Well-9
LWD-G-1-ScottsWell
LWD-G-2-Well
LWD-J-1-Well
LWD-R-1-Well
LWD-U-1-Well
Proposed DOH SAL

Non-detect values represented by 1/2 Reporting Limit. Hollow symbols with dashed lines are non-detect results, solid symbols with solid lines are detections.

Figure C5. Concentrations of Perfluorobutanesulfonic acid (PFBS) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

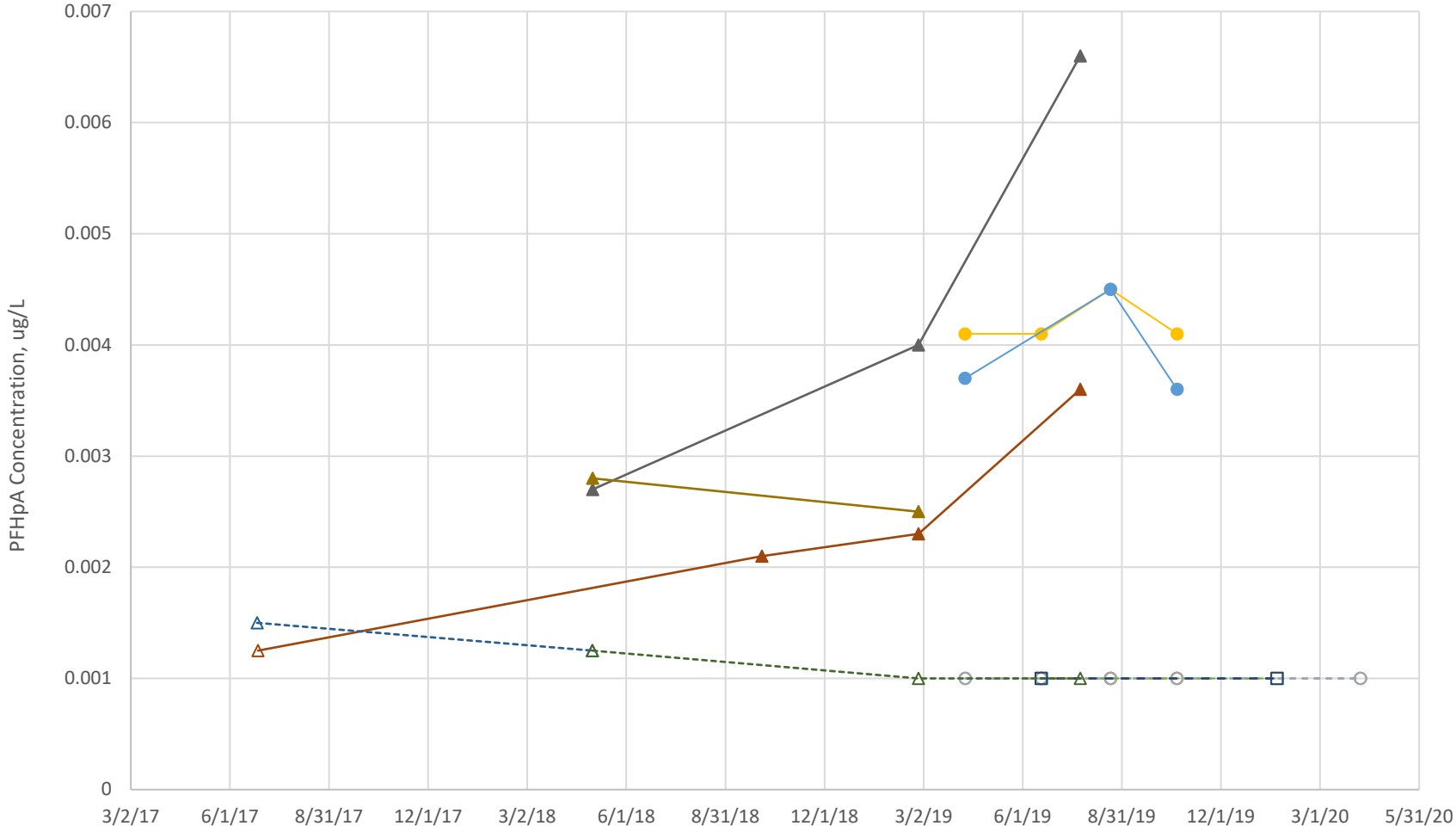
PgG



Non-detect values represented by 1/2 Reporting Limit. Hollow symbols with dashed lines are non-detect results, solid symbols with solid lines are detections.

Figure C6. Concentrations of Perfluorohexanoic acid (PFHxA) in Wells with Minimum Two Samples for Individual Constituent

PgG



DPT-BH-Well1
DPT-BH-Well2
DPT-BH-Well3
DPT-HH-Well1
DPT-HH-Well2
PLW-Well-7
PLW-Well-9
LWD-G-1-ScottsWell
LWD-G-2-Well
LWD-J-1-Well
LWD-R-1-Well
LWD-U-1-Well

Non-detect values represented by 1/2 Reporting Limit. Hollow symbols/dashed lines are ND, solid symbols/solid lines are detections (note that LWD-G-1-ScottsWell has both non-detect results and detections).

Figure C7. Concentrations of Perfluoroheptanoic acid (PFHpA) in Wells with Minimum Two Samples for Individual Constituent

2020 LWD PFAS Investigation-ECY Grant

PgG

APPENDIX D
EIM STUDY, LOCATION AND RESULTS FIELD

EIM Help – Location Template

Version 3.11

December 2020

How to use this help

Use this when you fill out your Location template. Each row corresponds to a column in the template. Color coding gives you a quick indication of required fields. **Yellow/Bold** = required; **Green** = required geographic position info; and **Blue/Bold** = required for wells. This information is also in the "Requirements" column.

General location info and metadata

All locations require general location information and metadata. Some columns are required for all locations, some are conditionally required depending on the type of location, and some are optional.

We appreciate getting optional information if you have it.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
A	**Location ID**	**Unique ID** to identify the field location in EIM.	**Required.**	Alpha.	15	Free text. **Must be unique within EIM.** Use a consistent naming convention. Facility/Site IDs, VCP numbers, etc. can be used as prefixes. Don't include depth information in this ID.	Ex. For monitoring well MW4 at Voluntary Cleanup site NW0001, use VCNW0001_MW4. Don't use MW-4 – it isn't unique. Don't add a new location to EIM where an existing soil boring location later had a monitoring well installed. Contact your Data Coordinator. They will convert the existing EIM soil boring location to a well location. **Tip:** For wells, you can use the Ecology Well Tag Number, like ABC123, for the Location ID. Download help for How to Name and Describe Field Locations. Location ID also goes in Column B of the Results template.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
B	**Location Name**	**Descriptive name** for a field location.	**Required.**	Alpha.	40	Free text.	Ex. "Skagit River at I-5 bridge." "VCNW0001 MW4." "Walla Walla WWTP Outfall." "UST excavation sample." **Tip:** For wells, you can use the Ecology Well Tag Number, like ABC123, for the Location Name. Download help for How to Name and Describe Field Locations.
C	**Location Setting**	General physical setting of a field location.	**Required.**	Alpha.	30	See table of Location Setting valid values (in this document).	For most Wells, enter "Land." These aren't regulatory definitions.
D	**Location Description**	Short narrative description of field location.	**Required.**	Alpha.	2000	Free text. Cleanup site locations can have more general descriptions.	Ex. "Skagit River upstream of I-5 bridge, north bank." "West side of property." "Walla Walla WWTP Outfall on Mill Creek." "SW wall of UST excavation." **Tip:** Include details that helps someone find your field location. Download help for How to Name and Describe Field Locations.
E	Ecology Facility/Site ID	ID of facility or site where the field location exists, from Ecology's Facility/Site database.	**Required for** cleanup and permit sites and/or if column BK (Is Well Upgradient of a Facility/Site) is Y**.**	Alpha.	10	Must be a valid Facility/Site ID. Search for Facility/Site ID in Cleanup Site Search (online). OR To find Facility/Site ID via the EIM Map, add the Facility/Site layer and use the Identify tool (online).	Ex. "1529149," "4085."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
F	**Is Location A Well**	Indicates the field location is a Well.	**Required for wells.**	Alpha.	1	**Y** yes, **N** no. If "Y," enter additional data in columns AH-BM.	Temporary Environmental Investigation Wells, or EIWS, are considered wells in EIM as of February 2015, but have fewer data entry requirements. Most are installed by direct push/Geoprobe®. Download help for Temporary Environmental Investigation Wells.
G	Address	Physical address of field location. Might not be the same as mailing address.	Optional.	Alpha.	200	Must be a valid address.	Ex. "424 128th Street NW."
H	City	City (or closest city) or area where field location exists.	Optional	Alpha.	40	Free text.	Ex. "Seattle," "Mt. Rainier National Park."
I	State	State or province where field location exists.	**Required if** location is outside WA.	Alpha.	2	**WA** Washington, **OR** Oregon, **ID** Idaho, **BC** British Columbia.	If your location is outside WA, fill in the state code, otherwise EIM won't recognize your coordinates.
J	Zip Code	Zip Code or Canadian Postal Code of the field location's physical address.	Optional.	Alpha.	10	Format: XXXXX or XXXXX-XXXX or XXX-XXX.	Ex. "98123-4567," "V0B-1H0."
K	County	County where field location exists.	Optional.	Alpha.	20	Must be a valid county name.	Ex. "Pierce."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
L	NHD Reach Code	Identifies the waterbody or watercourse on which the field location exists per the National Hydrography Dataset (NHD).	**Required for** streams, rivers, lakes, or nearshore locations.	Num.	14	To find a Reach Code, use the NHD tool in the EIM Map (online). For instructions, download help for Getting NHD info from the EIM Map.	Ex. "17100103000305" **Important:** Associate your Location with the correct waterbody or watercourse. Some north Puget Sound locations don't have Reach Codes.
M	NHD Reach Measure	Identifies where on a watercourse the field location exists per the National Hydrography Dataset (NHD). Percent distance from reach start.	**Required for** stream or river locations.	Num.	7	**0.000-100**. To find a Reach Measure, use the NHD tool in the EIM Map (online). For instructions, download help Get NHD info from the EIM Map.	Ex. "57.135." **Important:** Associate your Location with the correct position on a watercourse. Waterbodies like lakes don't have Reach Measures.

Horizontal coordinates

Submit only **one type of coordinates per location**. If you don't have coordinates, get them from the online EIM map, using the Lat/Long tool. Download help for Getting Lat/Long Coordinates and Elevations from Map.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
N	**Coordinate System**	Type of coordinates used to enter geographic position of field location into EIM.	**Required.**	Alpha.	8	**LAT/LONG** Latitude/Longitude in Degrees-Minutes-Seconds **or** Numeric Degrees, **SPCS** Washington State Plane Coordinate System, **UTM** Universal Transverse Mercator.	For LAT/LONG, submit deg-min-sec OR decimal degrees, **not both.**

Latitude/longitude degrees-minutes-seconds coordinates

Fill out this block if you have latitude/longitude **degrees-minutes-seconds** coordinates. Don't also submit other types of coordinates.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
O	Latitude Degrees	Degrees measure of the field location's latitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	2	**45** to **49.**	Distance north of the equator.
P	Latitude Minutes	Minutes measure of the field location's latitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	2	**00** to **59.**	
Q	Latitude Seconds	Seconds measure of the field location's latitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	5	**00.00** to **59.99.**	
R	Longitude Degrees	Degrees measure of the field location's longitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	3	**116** to **125.**	Distance east or west of Central Meridian (Greenwich England).
S	Longitude Minutes	Minutes measure of the field location's longitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	2	**00** to **59.**	
T	Longitude Seconds	Seconds measure of the field location's longitude.	**Required for** LAT/LONG in Deg-Min-Sec.	Num.	5	**00.00** to **59.99.**	

Latitude/longitude decimal degrees coordinates

Fill out this block if you have latitude/longitude **decimal degrees** coordinates. Don't also submit other types of coordinates.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
U	Latitude Decimal Degrees	Decimal degrees latitude coordinate for the field location.	**Required for** LAT/LONG in Decimal Deg.	Num.	9	**45.000000** to **49.999999.**	
V	Longitude Decimal Degrees	Decimal degrees longitude coordinate for the field location.	**Required for** LAT/LONG in Decimal Deg.	Num.	11	**116.000000** to **25.999999.** **or** **-116.000000** to **-125.999999.**	

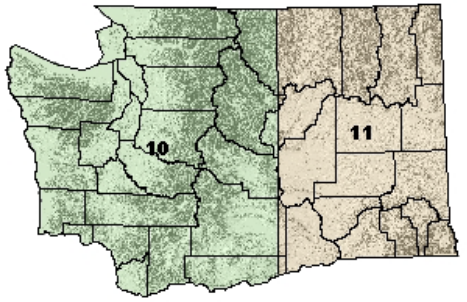
State Plane Coordinate System coordinates

Fill out this block if you have State Plane Coordinate System (SPCS) coordinates. Don't also submit other types of coordinates.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
W	State Plane X Coordinate	State Plane Coordinate System E-W coordinate (X-axis) of the field location. In feet.	**Required for** SPCS.	Num.	9	North Zone: **602913.0** to **2673266.0.** South Zone: **575078.0** to **2618128.0.**	
X	State Plane Y Coordinate	State Plane Coordinate System N-S coordinate (Y-axis) of the field location. In feet.	**Required for** SPCS.	Num.	8	North Zone: **-33488.0** to **832967.0.** South Zone: **15935.0** to **901121.0.**	
Y	State Plane Zone	State Plane Coordinate System zone (north or south) of the field location.	**Required for** SPCS.	Alpha.	1	**N** North, **S** South.	 *Figure 1: SPCS Zones in Washington State.*

Universal Transverse Mercator coordinates

Fill out this block if you have Universal Transverse Mercator (UTM) coordinates. Don't also submit other types of coordinates.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
Z	UTM Easting	Universal Transverse Mercator easting coordinate (X-axis) of the field location. In meters.	**Required for** UTM.	Num.	8	Zone 10: **350000.0** to **731300.0.** Zone 11: **271250.0** to **518176.0.**	
AA	UTM Northing	Universal Transverse Mercator northing coordinate (Y-axis) of the field location. In meters.	**Required for** UTM.	Num.	9	Zone 10: **042900.0** to **5454800.0.** Zone 11: **5042930.0** to **454795.0.**	
AB	UTM Zone	Universal Transverse Mercator zone (10 or 11) of the field location.	**Required for** UTM.	Num.	2	**10** **11**	 *Figure 2: UTM Zones in Washington State.*

Horizontal coordinate metadata

Most columns in this section are required for all locations.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AC	**Horizontal Coordinates Represent**	General description of what the coordinates represent.	**Required.**	Num.	2	**24** Discrete monitoring point. **25** Centroid of monitoring area. **26** Stream segment, can include riparian zone. **27** Transect, start point. **28** Transect, center point.	**For coordinates that don't represent a discrete monitoring point** (25-29), use the Location Description column (Column D) to describe the monitoring area, stream segment, or transect where data were collected. **26** applies to a length of stream segment. Only use it when you are collecting data from multiple points within a stream segment and you want all those data to be associated with a single EIM location. It's most commonly used for habitat data.
AD	**Horizontal Datum**	Model used to project the horizontal position of the field location to a map.	**Required.**	Num.	2	**2** NAD83 - N. American Datum of 1983. **3** NAD83HARN - High Accuracy Reference Network. **4** WGS84 - World Geodetic System of 1984.	**GPS Unit** = Check unit's settings for datum. **Google Earth** = WGS84. **EIM Map** = NAD83HARN.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AE	**Horizontal Coordinate Accuracy**	Best estimate of horizontal coordinate accuracy for a field location.	**Required.**	Num.	2	**1** ± 0.1 ft (0.03 m). **2** ± 1 ft (0.3 m). **3** ± 3 ft (1 m). **4** ± 10 ft (3 m). **5** ± 20 ft (6 m). **6** ± 40 ft (12 m). **7** ± 100 ft (30 m). **8** ± 180 ft (55 m). **9** ± 250 ft (76 m). **10** ± 500 ft (152 m). **11** ± 1000 ft or greater (300 m).	Download help for Horizontal Coordinate Accuracy.
AF	**Horizontal Coordinate Collection Method**	Method used to collect the horizontal coordinates for a field location.	**Required.**	Num.	2	**4** Address matching, unspecified. **8** Survey, conventional. **13** Computer map (GIS-based, including EIM or Google Earth). **16** GPS consumer unit or unknown (code phase). **29** GPS high-end consumer unit (DGPS or WAAS enabled). **15** GPS survey-grade unit (carrier phase). **17** GPS real time survey-grade (kinematic). **19** Paper map interpolation.	For more information about different GPS technologies, download help for Horizontal Coordinate Accuracy.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AG	Paper Map Scale	Scale of the paper base map used to determine the geographic position of the field location.	**Required only for** paper maps.	Num.	2	See table of Paper Map Scale valid values (in this document).	**Only fill this out if column AF,** Horizontal Coordinate Collection Method**, is code 19, "**Paper map interpolation."

Elevation and metadata

Elevation is optional for most locations, except for wells.

For **permanent wells**, we require the blue columns (also see "Requirements" column). Requirements are different for **Temporary Environmental Investigation Wells (EIWs).** If you submit elevations for EIWs, fill out columns AH-AM. Download the EIW help document for details.

For **marine and freshwater sediment locations,** fill out columns AH–AJ and AL–AN, if you're submitting elevations. For **all other locations,** fill out columns AH-AM if you're submitting elevations.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AH	**Elevation of**	Point at which the elevation at a field location was measured.	**Required for wells** except for EIWs with GW chemistry only.	Alpha.	50	**Land Surface** **Top of Well Casing** **Well Water Level Measuring Point** **Sediment Surface**	**Tip:** Use "Well Water Level Measuring Point" only if the measuring point isn't the top of casing (like an access port).

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AI	**Elevation**	The distance of a field location above or below a vertical reference point. In feet or meters.	**Required for wells** except for EIWs with GW chemistry only.	Num.	12	**-9999999.999** to **0000000.000** to **9999999.999**	Ex. "356," "-7.2" **Note:** This is the elevation of the point specified in column AH (Elevation of). **Marine and freshwater sediment surface** (or mudline) elevations are measured relative to a reference point like mean sea level (column AN). They are often (but not always) negative values.
AJ	**Elevation Units**	Units in which the elevation of a field location is expressed.	**Required for wells** except for EIWs with GW chemistry only.	Num.	2	**FT** feet. **M** meters.	
AK	**Elevation Datum**	Vertical reference point from which elevation was measured at a field location.	**Required for wells** except for EIWs with GW chemistry only.	Num.	2	**1** NAVD88 - N. American Vertical Datum of 1988.	**GPS unit** = Check unit's settings for datum. **Google Earth and EIM Map** = NAVD88. **Local datum** = You must convert your elevation data to NAVD88 if you used another datum, including local datums. Download help for Converting Local Elevation Datums to NAVD88. For sediment elevations, leave this column blank. See Sediment Elevation Reference (Column AN).
AL	**Elevation Accuracy**	Best estimate of elevation accuracy at a field location.	**Required for wells** except for EIWs with GW chemistry data only.	Num.	2	**1** ± 0.1 ft (0.03 m). **2** ± 1 ft (0.3 m). **3** ± 3 ft (1 m). **4** ± 10 ft (3 m). **5** ± 20 ft (6 m). **6** ± 40 ft (12 m). **7** ± 100 ft or greater (30 m).	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AM	**Elevation Collection Method**	The method used to measure elevation at a field location.	**Required for wells** except for EIWs with GW chemistry data only.	Num.	2	**2** Survey – conventional. **4** GPS consumer unit or unknown (code phase) **13** GPS high-end consumer unit (DGPS or WAAS enabled). **5** GPS survey-grade (carrier phase). **6** GPS real time survey-grade (kinematic). **3** Digital elevation model – WA 10 m. **12** LIDAR (airborne laser). **1** Bathymetric sounding. **14** Meter wheel. **8** Paper map interpolation.	
AN	Sediment Elevation Reference	Reference point for the depth (elevation) of a marine or freshwater sediment field location.	**Required only for** marine or freshwater sediment locations with elevation specified in the Elevation column (AI).	Num.	2	**1** Mean Sea Level (MSL). **2** Mean High Water (MHW). **3** Columbia River datum (CRD). **4** Lake Washington Ship Canal Datum (LWSC). **5** Mean Lower Low Water (MLLW). **6** Minimum Operating Pool (MOP). **14** Lake Washington Low Water (LWLW).	**Don't fill this out unless** the location is a sediment location (marine or freshwater). If you used a reference point not listed here, contact your Data Coordinator.

Well water level measuring point and metadata

For permanent wells, we require blue columns (also see "Requirements" column). Requirements are different for **Temporary Environmental Investigation Wells (EIWs).** Download the EIW help document for details.

We appreciate getting optional information if you have it.

Diagrams showing what the measuring point columns refer to

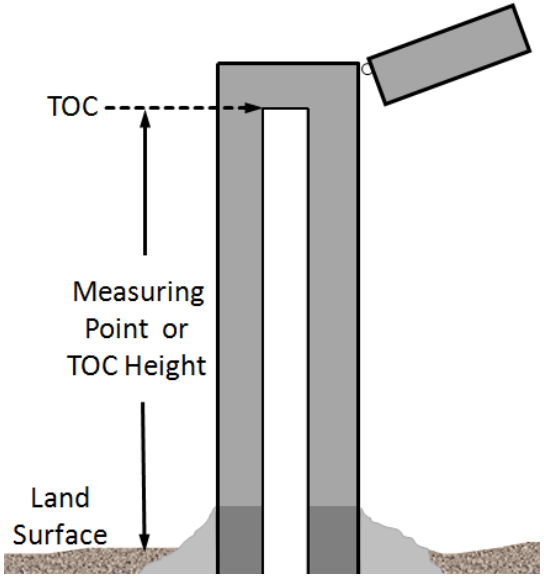


Figure 3: Well with casing stickup.

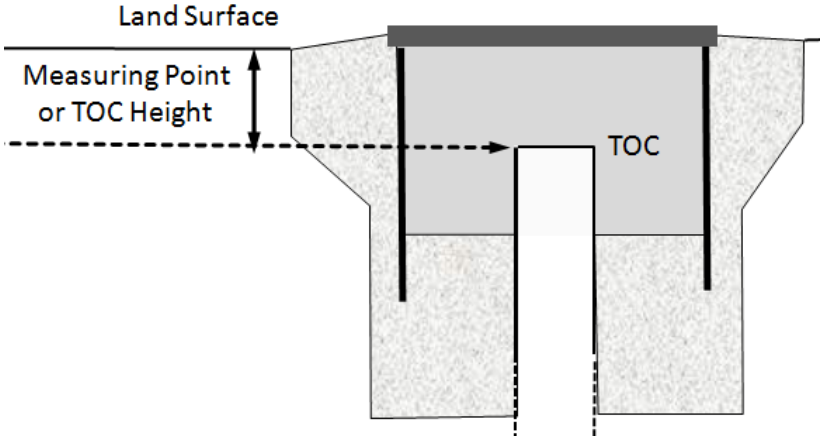


Figure 4: Flush-mount well.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
O	**Well Water Level Measuring Point or TOC ID**	ID for the point on the well from which water levels are measured. Often top of well casing (TOC).	**Required for wells** except for EIWs with GW chemistry data only.	Alpha.	8	**MP1** - measuring point - like an access port, **MP2** - use for a secondary measuring point, **TOC1** - use when you measure from top of casing, **TOC2** - use for a secondary measuring point at the top of casing or when the casing gets cut off.	**Tip: If the top of casing gets cut off** or you have more than one measuring point, contact your Data Coordinator. They will enter a new ID into EIM for you.
AP	**Well Water Level Measuring Point or TOC Description**	Description of the point on the well from which water levels are measured. Often top of well casing (TOC).	**Required for wells** except for EIWs with GW chemistry data only.	Alpha.	2000	Free text.	Ex. “Top of casing, notch on north side.”
AQ	Well Water Level Measuring Point or TOC Height	Distance from the point where the water level was measured to the land surface. Often top of well casing (TOC) or synonymous with “casing stickup.”	**Required for wells if** elevation is measured at land surface except for EIWs with GW chemistry data only**.**	Num.	5	Measuring points below land surface are reported as negative values.	Ex. “2.8” (above ground), Ex. “-0.5” (below ground). **This isn’t well elevation**; see the Elevation column (AI) for that.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AR	Well Water Level Measuring Point or TOC Height Units	Units in which the measuring point height is expressed.	**Required for wells if** Well Water Level Measuring Point or TOC Height is populated.	Alpha.	2	**FT** feet, **M** meters.	
AS	Well Water Level Measuring Point or TOC Start Date	Date on which the measuring point was first used.	Optional.	Date.	10	MM/DD/YYYY.	Ex. “3/15/1999.”

Well details

For permanent wells, we require blue columns (also see "Requirements" column). Requirements are different for **Temporary Environmental Investigation Wells (EIWs).** Download the EIW help document for details.

We appreciate getting optional information if you have it.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AT	Well Tag ID	The unique Washington State Department of Ecology well tag ID, consisting of three letters and three numbers (e.g. ABC123).	**Required for wells if available.**	Alpha.	6	Format: "ABC123." Leave blank If you don't have a valid well tag ID and it isn't practical to get one.	**Must** be the unique number off the Ecology well tag attached to a well. The ID is stamped on an aluminum tag and typically affixed to the well by the driller at the time of construction or later by Ecology staff. The ID is also included on the well log submitted by the driller. If a well isn't tagged, you can get one from Ecology. Because the Well Tag ID is unique in Washington, you can use it as the EIM Location ID and Location Name.
AU	Well Owner Organization Name	The organization name of the well owner.	**Required for wells if available.**	Alpha.	50	Free text.	Ex. "City of Olympia" or "Greenfields Farms." This information isn't made public.
AV	Well Owner Last Name	The last name of the well owner.	**Required for wells if available.**	Alpha.	50	Free text.	Ex. "Jones." This information isn't made public.
AW	Well Owner First Name	The first name of the well owner.	**Required for wells if available.**	Alpha.	50	Free text	Ex. "John." This information isn't made public.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
AX	**Ground-water Location Type**	The primary use or type of well or monitoring location.	**Required for wells.**	Alpha.	30	**Dewatering Well** **Geothermal Well** **In-Water Piezometer** **Injection Well - ASR** **Injection Well – Carbon Sequestration** **Injection Well - Remediation** **Irrigation Well** **Monitoring Well** **Pumping Well – Remediation** **Soil Gas Probe** **Stockwater Well** **Temporary Well - EIW** **Water Supply Well - Domestic** **Water Supply Well - Industrial** **Water Supply Well - Public** **Other**	Download help for EIWs (Temporary Environmental Investigation Wells).
AY	**Well Completion Depth**	The depth of the completed well below land surface. In feet or meters.	**Required for wells** except for EIWs with GW chemistry data only.	Num.	5		Ex. “48.84” Usually found on the well log.
AZ	**Well Completion Depth Units**	Units in which Well Completion Depth is expressed.	**Required for wells** except for EIWs with GW chemistry data only.	Alpha.	2	**FT** feet **M** meters	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
BA	**Well Completion Type**	The type of completion or nature of the openings that allow water to enter the well.	**Required for wells** except for EIWs with GW chemistry data only.	Alpha.	30	**Cased, Open Interval** **Uncased, Open Interval** **Cased, Open-Ended** **Other**	**Does your well have a screen?** Use "Cased, Open Interval." If "Other" explain the Completion Type in the Well Construction Comment (column BJ).
BB	**Well Open Interval Upper Depth**	Distance from land surface to the top of the Well open interval. Includes screens, perforations, etc. In feet or meters.	**Required for wells** except for EIWs with GW chemistry data only.	Num.	5		Ex. "20." Usually depth to top of well screen. To include more information about this, use Well Construction Comment. For open-ended wells, repeat Well Completion Depth (column AZ) in both Well Open Interval Upper Depth and Lower Depth.
BC	**Well Open Interval Lower Depth**	Distance from land surface to the bottom of the well open interval. Includes screens, perforations, etc. In feet or meters.	**Required for wells** except for EIWs with GW chemistry data only.	Num.	5		Ex. "23." Usually depth to bottom of well screen. To include more information about this, use Well Construction Comment. For open-ended wells, use Well Completion Depth (AZ) for both Well Open Interval Upper Depth and Lower Depth.
BD	**Well Open Interval Units**	Units in which the Well Open Interval Upper and Lower Depth is expressed.	**Required for wells** except for EIWs with GW chemistry data only.	Alpha.	2	**FT** feet, **M** meters.	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
BE	Well Maximum Casing Diameter	The inner diameter of the outermost permanent casing used to complete the well. In centimeters or inches.	Optional.	Num.	5		Ex. "2.00." Report the inner diameter of the well itself and not that of the outer protective casing.
BF	Well Maximum Casing Diameter Units	Units in which Well Maximum Casing Diameter is expressed.	**Required if** Well Maximum Casing Diameter is populated.	Alpha.	2	**CM** centimeters **IN** inches	
BG	Well Casing Material	Material from which the well casing is made.	Optional.	Alpha.	15	**Concrete** **Iron** **Plastic, other** **PTFE/Teflon** **PVC** **Steel, other** **Steel, Stainless** **Other**	
BH	Well Construction End Date	Date that well construction was completed.	**Required for wells if available.**	Date.	10	MM/DD/YYYY.	Ex. "01/01/2000."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
BI	Well Construction Method	The method used to create the borehole and construct the well.	**Required for wells if available.**	Alpha.	2	**AP** air percussion **AR** air rotary **BA** bored / augered **CT** cable tool **DR** driven / direct push **DU** dug **HR** hydraulic / mud rotary **JE** jetted **RR** reverse circulation rotary **SO** sonic	
BJ	Well Construction Comment	Comments or other important information about the construction of a well.	Optional.	Alpha.	2000	Free text.	Ex. “Well constructed by owner. Depth is unknown.”
BK	Is Well Upgradient of a Facility/Site	Indicates a well that is used to represent upgradient conditions at a particular facility or site, and is (known or assumed to be) unaffected by that site. Doesn’t necessarily reflect "pristine" or "natural" conditions.	Optional.	Alpha.	1	**Y** yes **N** no Ecology Facility/Site ID is required if populated "Y."	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Comments
BL	Aquifer Test Report in EIM	Indicates that an aquifer or pumping test report prepared by a hydrogeologist or engineer has been uploaded to EIM.	**For internal use only. Leave it blank.**			Leave this column blank.	**If you want an aquifer test report uploaded to EIM**, contact your Data Coordinator. Not for short-term bailer or air lift tests performed by the driller during well construction or development.
BM	Naturally Flowing Well	Indicates whether an uncapped well would naturally flow due to artesian pressure.	**Required for wells if** well is naturally flowing.	Alpha.	1	**Y** yes **N** no	

EIM Location Setting valid values

Note - These aren't regulatory definitions.

Valid Value	Description
Air/Climate	Atmospheric monitoring.
Canal/Ditch	Man-made channel for irrigation, hydropower, overflow, drainage etc.
Estuary	Area where fresh and salt water intermix, like bay, lagoon, etc.
Estuary-Channel	Estuary channel bottom.
Estuary-NonChannel	Estuary non-channel bottom.
Intertidal	Area between high and low tide extremes.
Lake/Pond/Reservoir	Inland water body, usually fresh.
Land	On or below land surface, including most wells.
Marine	Area beyond the estuarial environment.
Source-ManMade	Industrial, agricultural, stormwater, sewer or other source, discharge or lagoon.
Spring/Seep	Where groundwater discharges to land surface.
Stream/River	Channeled, flowing water.
Stream/River-Channel	Stream/River channel bottom.
Stream/River-NonChannel	Stream/River non-channel bottom.
Stream/River-Pool	Stream/River pool bottom.
Stream/River-Riffle	Stream/River riffle bottom.
Subtidal	Area below low tide.
Tunnel/Shaft/Mine	Vertical/ horizontal subsurface passageway.
Wetland	Land that is saturated by surface or ground water, either permanently or seasonally.
Other	Use when none of the other categories fit.

Go back to Location Setting help

EIM Paper Map Scale valid values

Valid Value	Description
9	1:25,000
10	1:24,000
13	1:10,000
14	1:12,000
15	1:25,001-1:50,000
16	1:50,001-1:100,000
17	1:20,001-1:25,000
20	1:5,001-1:10,000
21	1:501-1:5,000
22	>1:500
23	<1:500
99	Unknown

Go back to Paper Map Scale help

Document Revision History

Revision Date	Revision No.	Summary of Changes	Reviser(s)
9/10/2013	2013.01	Changes to EIM data model.	CN
10/13/2017	3.0	Changed versioning system and made formatting updates for new help center.	CN
04/25/2018	3.1	Added “Estuary” and “Stream/River” to definitions under those categories.	CN
10/04/2018	3.2	Retired value “1” (NAD27 - N. American Datum of 1927) from Horizontal Datum (AD) and “Oil and Gas Well” from Groundwater Location Type.	CN
01/23/2019	3.3	Added “Soil Gas Probe” to Groundwater Location Type valid values and “Spring/Seep” to Location Setting valid values.	KC
06/24/2019	3.4	Added link to new Horizontal Coordinate Accuracy help document.	KC
08/06/2019	3.5	Added link to “Cleanup Site Search” for FSID.	KC
03/19/2020	3.6	Deleted Elevation Accuracy valid value codes 8-11 and updated definition for code 7.	KC
04/09/2020	3.7	Added link to help document in Horizontal Coordinate Collection Method, removed valid value 29 (Transect, end point) from Horizontal Coordinates Represent.	KC
05/08/2020	3.8	Removed unused valid values 2-8, 11, 12, 18, 19 from Paper Map Scale and added Unknown.	KC
06/15/2020	3.9	Updated Location Name info (no longer required, but needs to be descriptive) and Location Description (can be more general for cleanup sites). Updated document name for link to “How to Name and Describe Field Locations.” Updated links. Increased font size from 10 to 11. Other accessibility edits like breaking apart singe table and adding headings.	CN
11/10/2020	3.10	Updated capitalization of “Is Location a Well” to “Is Location A Well” to match the template.	KC
12/03/2020	3.11	Removed an example from Well Construction Comment	KC

EIM Help – Study Form

Version 3.9

September 2020

How to use this help

Use this when you fill the online Study form in the EIM Loader (public) or Editor (Ecology staff). Each row corresponds to a field in the form.

Color coding

Required fields in the online form are denoted by an asterisk. In the help below, **Yellow/Bold*** = **Required**. Also see "Requirements" column.

Study form fields

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Study ID*	**Unique ID** to identify the study in EIM. Also see info about Study ID Alias (in this document).	**Required.**	Alpha-numeric.	20	Free text / preferred format.	Ex. "WQC-2015-00104," "VCSW0123," "AJOH0012," "BCWTAC95." - **Grants** - see "Naming Conventions for EIM Studies," link below. - **Voluntary Cleanup Program** - use "VC" followed by your VCP number (ex. VCSW0123). - **Sediment studies** - use 8 or fewer characters. First 6 characters represent the study or facility; last 2 are study start date (ex. BCWTAC95). Download help for "Naming Conventions for EIM Studies."

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Study Name*	UNIQUE title that describes the study.	**Required.**	Alpha-numeric.	254	Free text.	Ex. "USA Petroleum Facility #190, Soil and Groundwater Cleanup, Lynnwood, WA" or "Long term marine waters monitoring data for water year 1989." **Tip** - This is a searchable field so include key words for searching.
EIM Data Entry Review Status	Indicates if data loaded into EIM has undergone a documented internal review for accuracy and completeness of data entry. The review process varies by environmental program within Ecology. This field differs from the QA Assessment Level, which is a rank of overall data quality according to Study-specific quality assurance procedures.	**Required only for** Ecology staff.	Alpha-numeric.	15	- **Reviewed** - Data loaded into EIM has undergone a documented review for accuracy and completeness of data entry. - **Not Reviewed** - Data loaded into EIM has NOT undergone a documented review for accuracy and completeness of data entry.	This field is for internal use only and is not available for external data submitters. All studies loaded to EIM by external partners default to "Not Reviewed." If the receiving program at Ecology has a documented EIM data review process, the data coordinator who loads the Study into EIM can set the Status to "Reviewed" if and when appropriate. An Ecology program that does not have a documented EIM data entry review process should choose "Not Reviewed" when entering a Study. A program that has a documented process should follow their guidance to determine when the Study's EIM Data Entry Review Status should be set to "Reviewed."
Study Type*	General nature of the study.	**Required.**	Alpha-numeric.	30	Pick valid value from the drop-down list in the Study form. See table of Study Type valid values (in this document).	Ex."Contaminated site investigation (characterization, includes RI/FS and remedial design)." **VCP sites** - use a VCP-specific Study Type.

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Study Purpose*	Summary of the study's purpose, reason(s) for initiating, and goals and expectations.	**Required.**	Alpha-numeric.	2000	Free text.	Ex. "Investigate ground-water quality, surface-water quality, water levels, streamflow and the relationship between ground water and surface water in the Quilceda Creek watershed."
Ecology Contact*	Name of the person at Ecology to contact about this study. Includes site manager, grant manager, project lead or other Ecology contact.	**Required.**	Alpha-numeric.	50	Pick valid value from the drop-down list in the Study form.	Ex. "Smith, Brian." **Tip** - Start typing the last name of the person to find them in the list.
Ecology Program or other Responsible Entity*	Name of the Ecology program and region OR external entity under which a study was conducted.	**Required.**	Alpha-numeric.	30	Pick valid value from the drop-down list in the Study form. See table of Ecology Program or other Responsible Entity valid values (in this document).	Ex. "Ecy Toxics Cleanup Program, Southwest Region" or "Ecy Water Quality Program, multi-region or statewide."
Study QA Planning Level*	Level of quality assurance planning for a Study.	**Required.**	Alpha-numeric.	1	Pick valid value from the drop-down list in the Study form: - **1** - Informal or no QA documentation. - **2** - Generic or incomplete document. - 3 - QAPP, SAP, or equivalent. - **4** - Approved QAPP or SAP. See expanded table of Study QA Planning Level valid values and definitions (in this document).	

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Study QA Project Plan Description	A summary of the Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP) approved for the Study. A QAPP or SAP is required for Study QA Planning Levels 3 and 4.	Optional	Alpha-numeric.	2000	Free text.	Ex. "Monitoring for Total Dissolved Gas (TDG) in the Pend Oreille River, for development of TDG Total Maximum Daily Load (TMDL). TDG will be monitored continuously near Ruby. Data quality, analytical, and reporting procedures are described." For QAPPs and SAPs developed outside of Ecology, please include information on where they can be located.
Study QA Assessment Level*	Level of quality assurance performed on the data.	**Required.**	Alpha-numeric.	30	Pick valid value from the drop-down list in the Study form: - **1** - Data neither Verified nor Assessed for Usability. - **2** - Data Verified. - **3** - Data Verified and Assessed for Usability. - **4** - Data Verified and Assessed for Usability in a Formal Study Report. - **5** - Data Verified and Assessed for Usability in a Peer-Reviewed Study Report. - **See Results** - For data validated by third-party experts following USEPA guidance and functional guidelines. Also for Bioassay data validated using QA1 or QA2. See expanded table of Study QA Assessment Level valid values and definitions (in this document).	Select “See Results” if your data has been validated by a third-party expert following USEPA guidance and functional guidelines. If you select this option you must fill out the Result Validation Level field in your Results spreadsheet. See the Results spreadsheet help document for additional guidance. If you have bioassay data which has been validated using QA1 or QA2, you must fill out the Bioassay QA Level in your Bioassay spreadsheet. See the Bioassay spreadsheet help document for additional guidance.

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Study Result Description	Summary of the results of the study.	Optional	Alpha-numeric.	2000	Free text.	Ex. "Water supply is of good quality and appears ample to meet current demands with a few exceptions. Slightly elevated chloride concentrations are found around Otso Point, Lyle Point peninsula, and Cole Point peninsula. See report for more details."
Study Comment	Additional comments about the study.	Optional	Alpha-numeric.	2000	Free text.	Ex. "Water and biological samples were collected for this study. Only the fish tissue data from this report has been entered into this EIM project."
Ecology Funding Number	The number assigned by Ecology to a grant, loan, forgivable loan, or contract. Previously known as the Ecology Grant Number or Ecology Loan Number. In 2015, Ecology moved to a new numbering system.	**Required for** Studies funded by an Ecology grant, loan, or contract.	Alpha-numeric.	50	Free text / preferred format.	Ex. “WQC-2015-MSRF-00104” (current). Ex. "G0200309" (pre-2015). **2015 onward:** - Number generated by Ecology Administration of Grants & Loans (EAGL) database. **Pre-2015:** - **G**, plus 7 numbers (grant). - **L**, plus 7 numbers (loan). - **C**, plus 7 numbers (contract).
Ecology Facility/Site ID	ID of facility or site where the field location exists, from Ecology’s Facility/Site database.	**Required for** WQ permit, landfill, and cleanup site studies (except Initial Investigation or Site Hazard Assessment).	Alpha-numeric.	10	Search for Facility/Site ID and Cleanup Site ID in Cleanup Site Search (online).	Ex. "1529149," "4085."

Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
Ecology Cleanup Site ID	ID of the site where the field location exists, from Ecology's Integrated Site Information System (ISIS).	**Required for** all cleanup site studies (except Initial Investigation or Site Hazard Assessment).	Alpha-numeric.	5	Search for Facility/Site ID and Cleanup Site ID in Cleanup Site Search (online).	Ex. "5771."

Go back to Study form grid

EIM Study Type valid values

Key

- Yellow highlight/asterisk - Requires FSID and CSID.
- Green highlight/hashtag - Requires FSID.

Cross-program or other

- General environmental study.
- Routine ambient monitoring.
- Best Management Practices (BMP) effectiveness monitoring.
- Source control - identifying and managing sources of contamination
- Bioaccumulation study.
- # Landfills - routine monitoring and Waste 2 Resources program (W2R) cleanups.
- # Pollution Liability Insurance Agency (PLIA) Petroleum Technical Assistance Program (PTAP) cleanup.

Toxics cleanup-specific (can also apply to sediments)

- Investigation of suspected contaminated site during Initial Investigation or Site Hazard Assessment.
- * Contaminated site investigation (characterization, includes RI/FS and remedial design).
- * Performance monitoring for emergency or interim cleanup action at contaminated site.
- * Performance monitoring for final cleanup action at contaminated site.
- * Post-cleanup, long-term confirmational monitoring of remediated contaminated site (periodic review, operation, and maintenance).
- * Voluntary Cleanup Program (VCP).
- Voluntary Cleanup Program (VCP) – awaiting application approval.

Sediment-specific

- Sediment disposal site monitoring.
- Sediment dredging study.
- # Monitoring for NPDES permit requirements.

Water quality-specific

- Total Maximum Daily Load (TMDL) development.
- Total Maximum Daily Load (TMDL) effectiveness monitoring.
- Municipal Stormwater permit, status and trends (receiving water) monitoring.

Habitat-specific

- Habitat monitoring, including status and trends monitoring.
- Stressor identification - identifying probable cause(s) of biological impairment (303(d)).

Go back to Study form grid

EIM Ecology programs and other responsible entities valid values

Ecology programs

Toxics Cleanup

- Ecy Toxics Cleanup Program (multi-region or statewide).
- Ecy Toxics Cleanup Program, Central Region.
- Ecy Toxics Cleanup Program, Eastern Region.
- Ecy Toxics Cleanup Program, Headquarters.
- Ecy Toxics Cleanup Program, Northwest Region.
- Ecy Toxics Cleanup Program, Southwest Region.

Hazardous Waste

- Ecy Hazardous Waste Program, Northwest Region.
- Ecy Hazardous Waste Program, Southwest Region.
- Ecy Hazardous Waste Program, Central Region.

Water Quality

- Ecy Water Quality Program (multi-region or statewide).
- Ecy Water Quality Program, Central Region.
- Ecy Water Quality Program, Eastern Region.
- Ecy Water Quality Program, Northwest Region.
- Ecy Water Quality Program, Southwest Region.

Water Resources

- Ecy Water Resources Program, Central Region.
- Ecy Water Resources Program, Eastern Region.
- Ecy Water Resources Program, Northwest Region.
- Ecy Water Resources Program, Southwest Region.

Shorelands

- Ecy Shorelands Program, Central Region.
- Ecy Shorelands Program, Eastern Region.
- Ecy Shorelands Program, Northwest Region.
- Ecy Shorelands Program, Southwest Region.

Solid Waste (formerly W2R)

- Ecy Solid Waste Program, Central Region.
- Ecy Solid Waste Program, Eastern Region.
- Ecy Solid Waste Program, Northwest Region.
- Ecy Solid Waste Program, Southwest Region.

Other

- Ecy Air Program.
- Ecy Environmental Assessment Program.
- Ecy Industrial Program.
- Ecy Nuclear Waste Program.
- Ecy Office of the Columbia River.
- Ecy Spills Program.

Other responsible entities

Sediments

- Dredged Material Management Program (DMMP).
- Naval Facilities Engineering Command Northwest (NAVFAC-NW).
- Puget Sound Dredge Disposal Analysis (PSDDA).
- US Army Corps of Engineers, Portland District.
- US Army Corps of Engineers, Seattle District.
- US Army Corps of Engineers, Walla Walla District.

Other (can also apply to sediments)

- National Oceanic and Atmospheric Administration / National Marine Fisheries Service.
- Oregon Department of Fish and Wildlife.
- Pollution Liability Insurance Agency (PLIA).
- Puget Sound Ambient Monitoring Program (PSAMP).
- Puget Sound Estuary Program (PSEP).
- University of Washington Oceanography.
- US EPA Environmental Monitoring and Assessment Program (EMAP).
- Ecy delegated US EPA National Pollution Discharge Elimination System (NPDES).
- US EPA Region 10.
- US EPA Superfund Program.
- Washington State Department of Agriculture, Dairy Nutrient Management Program.
- Washington State Department of Agriculture, Natural Resources Assessment Section.
- Washington State Department of Fish and Wildlife, Puget Sound Ecosystem Monitoring Program.
- Washington State Department of Natural Resources (WDNR).

Go back to Study Form grid

EIM Study QA Planning Level valid values

Levels

Level 1

Informal or no QA documentation

Level 2

Generic or incomplete document

Level 3

QAPP, SAP, or equivalent

Level 4

Approved QAPP or SAP

Definition of terms

QA Planning Document

Includes a description of the Study, statements of Study objectives, detailed sampling design including rational and sampling locations, and descriptions of, or references to, sampling, analysis, and quality control procedures.

Quality Assurance Project Plan (QAPP)

Must follow guidance in Ecology Publication 04-03-030, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies and/or EPA Document 841-B-96-003, The Volunteer Monitor's Guide to Quality Assurance Project Plans.

Sampling and Analysis Plan (SAP)

Must follow Model Toxics Control Act WAC 173-340-820, Sampling and Analysis Plans AND Ecology Publication 04-03-030, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. For sediment data, must follow Ecology Publication 12-09-057 (2019 revision), Sediment Cleanup User's Manual (SCUM) II.

Approved QAPP or SAP

The QAPP or SAP was reviewed and approved for accuracy and completeness prior to the start of sampling by Study participants, peers, supervisors, laboratory staff, and/or quality assurance officers, typically from the organization that conducted or funded the Study.

Go back to Study Form grid

EIM Study QA Assessment Level valid values

Levels

Level 1

Data neither Verified nor Assessed for Usability.

Level 2

Data Verified.

Level 3

Data Verified and Assessed for Usability.

Level 4

Data Verified and Assessed for Usability in a Formal Study Report.

Level 5

Data Verified and Assessed for Usability in a Peer-Reviewed Study Report.

See results

For data validated by third-party experts following USEPA guidance and functional guidelines. Also for Bioassay data which is has been validated using QA1 or QA2. See “Result Validation Level” field in the Results spreadsheet and or “Bioassay QA Level” field in the Bioassay spreadsheet. See Results and Bioassay spreadsheet help documents for more information on third-party validation.

Definition of terms

Data Verified

Study quality control (QC) results have been examined for compliance with acceptance criteria specified in the QAPP, SAP or field/analytical method.

Data Assessed for Usability

Study data package has at a minimum been evaluated for precision, bias, representativeness, comparability, and completeness as specified in the QAPP or SAP.

Formal Study Report

Document describing Study objectives, procedures, results, conclusions and assessment of the quality of the data. Bibliographic citations should be provided.

Peer Reviewed Study Report

Report was checked or reviewed for accuracy and completeness by a supervisor or colleague with appropriate experience (does not require independent, outside scientific review, as for juried publications).

Go back to Study Form grid

Study ID Alias

Study ID Alias is an optional, alternate Study ID we can assign to your EIM study. You can use it to search for your study in the Study ID field in EIM Search. A study can have one or more aliases. Types include:

- Former Study ID, for renamed or assimilated studies. (Example: VCNW2316).
- Your organization's ID. (Example: DMMP-SANDY-A-179-02).
- Another ID associated with the study, like an agreed order or VCP number. (Example: AODE10651).

Linking documents related to EIM studies

Documents related to EIM studies include Ecology publications and reports from Ecology partners, like environmental consultants and grant recipients. We don't store these documents in EIM; they are in other Ecology systems and we link them to EIM when we can. The links display in EIM Search on the Study Data Summary page. Each Ecology Program, like Toxics Cleanup and Water Quality, has their own process for linking documents to EIM studies. To find out more, download "How to Link Documents to EIM Studies." **Note:** We can't link to documents stored outside of Ecology.

Document revision history

Revision Date	Revision No.	Summary of Changes	Reviser(s)
9/10/2013	2013.01	Changes to EIM data model.	CN
2016	2016.01		
10/5/2017	3.0	Changed versioning system. Changes for new Help System. Moved to Word/PDF from Excel for accessibility reasons.	CN
01/09/2018	3.1	Updated examples for Ecology Funding Number. Size increased from 8 characters to 50 to accommodate new numbering system. Added missing field sizes.	KC, CN
03/08/2018	3.2	Added new study type for PLIA.	KC
07/23/2018	3.3	Updated instructions for Study ID to include new Ecology Funding Number-based ID for grants. Changed "EIM Ecology programs and other responsible entities valid values" "Waste 2 Resources	CN

Revision Date	Revision No.	Summary of Changes	Reviser(s)
		Program" to "Solid Waste Program."	
03/21/2019	3.4	Added "Ecy Hazardous Waste Program, Central Region" to "Ecy Ecology Programs and other responsible entities valid values" list.	KC
06/27/2019	3.5	Added link to "Cleanup Site Search" for CSID and FSID. Easier to use than old way.	CN
03/08/2020	3.6	Added Study ID Alias information and addressed accessibility items.	CN
6/22/2020	3.7	Updated link, changed "Monitoring for NPDES permit requirements" to "Required" for Study Type, increased font size from 10 to 11 pt.	CN
09/03/2020	3.8	Added "Linking documents related to EIM studies" section.	KC, CN
09/29/2020	3.9	Removed the yellow highlight and asterisk from the EIM Study Type valid values list from "Voluntary Cleanup Program (VCP) – awaiting application approval".	KC

EIM Help – Results Template

Version 3.6

June 2020

How to use this help

Use this when you fill out your Results template. Each row corresponds to a column in the template.

Color coding

Color coding gives you a quick indication of required fields. **Yellow/Bold** = **Required**; Purple = Required if Field Collection Type is Sample or Measurement; Orange = Required if Field Collection Type is Sample. This information is also in the "Requirements" column.

Color coding for labs: See the bars on the left side of the columns. These are the minimum fields you should populate for your clients: **Dark Red** = **Required**; **Pink** - Required if applicable; **Green** = Required for specific tissue or taxonomic data.

Other templates

Did you use a deployed instrument to collect continuous data? Enter your data in the **Time Series Results Template**. Did you collect discrete water levels from wells? Enter your data in the **Well Water Level Template**. Find them in EIM Help Center.

Template help

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
A	**Study ID**	UNIQUE ID to identify the Study in EIM.	**Required.**	Alpha-numeric.	20	Must be valid EIM Study ID.	Use value from "Study ID" field in your Study form.
B	**Location ID**	UNIQUE ID to identify the field Location in EIM.	**Required.**	Alpha-numeric.	15	Must be valid EIM Location ID.	Location ID's are from Column A in your Location template. You will commonly have multiple result records associated with the same Location ID. All result records associated with a particular sampling location will use that Location ID.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
C	**Study Specific Location ID**	Unique ID to identify the field location within a particular Study. Only needs to be unique to the Study, not all of EIM. Can be the same as Location ID, an abbreviation of Location ID, or something totally different.	**Required.**	Alpha-numeric.	40	Free text / preferred format. An ID of 8 characters or less will display better on the GIS map.	Ex: If your Location ID for a monitoring well is "CITGO-34586-MW4," your Study-Specific Location ID could be "MW-4." It's often the location identifier that's written on the sample tag or label. Each Location ID must be paired 1-to-1 with a Study Specific Location ID. Once you establish a Location ID/Study Specific Location ID pairing (by submitting data in the Results Template), use the same pairing for all future data submittals to your Study. If you aren't sure what Location ID/Study-Specific Location ID pairings were previously used in your Study, download your Results data from EIM Search to view them or contact your Data Coordinator. Download help for "Naming and Describing for EIM Field Locations."
D	**Field Collection Type**	General type of data collection conducted in field.	**Required.**	Alpha-numeric.	11	- **Sample** - discrete sample collected in the field that is sent to a lab for analysis. - **Measurement** – discrete data collected in the field using an instrument, like pH meter. - **Observation** - record of an unsuccessful measurement or sampling attempt.	**For Observations,** enter a record only if a sample or measurement was planned or required but not obtained. Download help for "Entering Observations" **For Time Series data,** (deployed instrument that collected continuous measurements) use the Time Series Template.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
E	**Field Collector**	Name or type of organization that collected the data.	**Required.**	Alpha-numeric.	15	Must be a valid EIM Field Collector Code. See table of Field Collector valid values (in this document).	Ex. “Consultant.”
F	**Field Collection Start Date**	Date that field data collection began.	**Required.**	Date.	10	MM/DD/YYYY.	Ex. "06/23/1999."
G	Field Collection Start Time	Time that field data collection began, in local time. EIM automatically assigns time zone (PDT or PST) based on Field Collection Start Date.	**Required if available.**	Time.	8	HH:MM:SS (24 hour) in local time.	Ex. "15:22:14."
H	Field Collection End Date	Date that field data collection ended.	Optional.	Date.	10	MM/DD/YYYY.	Ex. "06/23/1999." Leave blank for discrete samples. Only for data collection that took place over time, like temporal composites and other special cases.
I	Field Collection End Time	Time that field data collection ended, in local time. EIM automatically assigns time zone (PDT or PST) based on Field Collection End Date.	Optional.	Time.	8	HH:MM:SS (24 hour) in local time.	Ex. "15:22:14." Only for data collection that took place over time, like temporal composites and other special cases.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
J	Field Collection Comment	Comments or descriptive information about the collection of data in the field.	Optional.	Alpha-numeric.	2000	Free text.	Ex. "Cows in stream upgradient of sampling site." You can have only **one Field Collection Comment per field collection event**. A Field collection event is **all Measurements collected at the same** location, depth, date, time, matrix and source **or all Samples collected at the same** location, depth, date, matrix and source, and Sample ID. For Samples, this means you can only have one Field Collection Comment per Sample ID. If you enter more than one Field Collection Comment per field collection event, EIM only takes the first one loaded. All Results associated with a specific field collection event have the same Field Collection Comment. If you want to comment about a particular result or group of results within a field collection event, enter it as a Result Comment or Result Additional Comment. Download help for "How to Use EIM's Comment fields."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
K	Field Collection Area	The area in which the collection of field data occurred. For benthic macroinvertebrate (e.g. kick-net area) and periphyton (surface area of substrate scraped) count data. Also for spatial composite samples.	**Required for** macro-invertebrate and periphyton counts.	Numeric.	10	Must be a number.	Ex. "8.20." Download help for “Periphyton Counts” Download help for "Benthic Invertebrate Identification and Counts”
L	Field Collection Area Units	Units of measure associated with Field Collection Area.	**Required if** Field Collection Area is populated.	Alpha-numeric.	10	- **cm2** - square centimeters. - **m2** - square meters. - **ft2** - square feet.	
M	Field Collection Reference Point	Point from which collection depth of field data was measured.	**Required for:** - Sediment, sediment porewater, and soil data. - Chemistry data from Temporary Environmental Investigation Wells. - Water column profile data.	Alpha-numeric.	30	- **Land Surface** - **Water Surface** - **Sediment Surface** - **Floor of Structure**	Download help for “Entering Field Collection Depth or Height.”

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
N	Field Collection Upper Depth	Distance from Reference Point to upper boundary where field data was collected. Positive values represent depths below reference point Negative values represent distance above reference point. If a discrete sample is collected at one depth, Upper and Lower Depth are the same value.	**Required for:** - Sediment, sediment porewater, and soil data. - Chemistry data from Temporary Environmental Investigation Wells. - Water column profile data.	Numeric.	10	Must be a number.	Ex. **Composite Sample**: "5" if soil sample was taken between 5 and 7.5 feet below land surface. Ex. **Discrete Sample**: "5" if soil sample was taken 5 feet below land surface. Download help for "Entering Field Collection Depth or Height." **Things that DON'T go in this field:** - Elevation. - Well water level depth or elevation. - Well groundwater sample depth - except for Temporary Environmental Investigation Wells (download help).
O	Field Collection Lower Depth	Distance from Reference Point to lower boundary where field data was collected. Positive values represent depths below reference point. Negative values represent distance above reference point. If a discrete sample is collected at one depth, Upper and Lower Depth are the same value.	**Required for:** - Sediment, sediment porewater, and soil data. - Chemistry data from Temporary Environmental Investigation Wells. - Water column profile data.	Numeric.	10	Must be a number.	Ex. **Composite Sample**: "7.5" if soil sample was taken between 5 and 7.5 feet below land surface. Ex. **Discrete Sample**: "5" if soil sample was taken 5 feet below land surface. Download help for "Entering Field Collection Depth or Height." **Things that DON'T go in this field:** - Elevation. - Well water level depth or elevation. - Well groundwater sample depth - except for Temporary Environmental Investigation Wells (download help).

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
P	Field Collection Depth Units	Unit of measure associated with Field Collection Upper Depth and Field Collection Lower Depth.	**Required for** results where Field Collection Upper and Lower Depth is populated.	Alpha-numeric.	10	- **cm** - centimeters. - **m** - meters. - **in** - inches. - **ft** - feet.	
Q	Well Water Level Measuring Point or TOC ID	ID for the point on the well where water levels are measured. Often top of well casing (TOC).	**Required only for** well water levels. Not needed for groundwater chemistry data.	Alpha-numeric.	8	- **TOC1** - **MP1** Must be the same value you submitted in your Location Template or that is stored in EIM.	EIM uses this to tie water level depths to the well elevation in order to calculate water level elevation and depth below land surface. For **discrete water level data**, you can also use the Well Water Level Template and Help (in EIM Help Center). For **well transducer data** use the Time Series Results Template and Help (in EIM Help Center).

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
R	Sample ID	Primary ID to identify a sample. May be selected by the sampler or assigned by the lab.	**Required if** Field Collection Type is Sample.	Alpha-numeric.	50	Free text. Must match the corresponding Sample ID used in reports or other documents.	Ex. "1304017-04" or “C1” or “MW1.” The laboratory-assigned sample ID is often entered in this field, but not always. For example, upland cleanup sites commonly use IDs like MW1 to identify the location from which the sample was collected. Check with your data coordinator if you have questions about Sample IDs. Split samples sent to different labs must be assigned the same Sample ID before entry into EIM. Don’t enter the data with mismatching lab-assigned sample IDs. This includes bioassay and chemistry data from the same sample. For information on Sample IDs and field replicates, download help for "Entering Field Replicates."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
S	Sample Field Replicate ID	Secondary ID to identify a field replicate sample. Field replicates are separate samples identically collected as close as possible to the same point in space and time as the original sample. They are stored in separate containers, each of which is identically processed and analyzed. Field replicates provide insight into field and laboratory procedure variability (and in some cases contaminant distribution).	**Required if** sample is a replicate and shares a Sample ID with one or more samples.	Alpha-numeric.	4	Free text / preferred format.	Ex. 1, 2, 3, or FR1, FR2, FR3, etc. Replicate samples often have separate Sample IDs; however, they may have the same Sample ID in some instances. The Sample Field Replicate ID is necessary to differentiate them in these cases. Download help for "Entering Field Replicates."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
T	Sample Replicate Flag	Indicates that the sample is a field replicate. Field replicates are separate samples identically collected as close as possible to the same point in space and time as the original sample. They are stored in separate containers, each of which is identically processed and analyzed. Field replicates provide insight into field and laboratory procedure variability (and in some cases contaminant distribution).	**Required if** sample or measurement is a field replicate.	Alpha-numeric.	1	- **Y** - Yes - **N** - No	Download help for "Entering Field Replicates."
U	Sample Sub ID	Secondary ID to identify a set of field split samples. Mostly used for sediment data. For split samples with the same Sample ID or with different Sample IDs.	**Required if** sample is a field split and shares a Sample ID with one or more sub-samples.	Alpha-numeric.	4	Free text / preferred format. First split is 1, second is 2, etc., no matter what the Sample ID is.	Ex. 1, 2, 3, or SS1, SS2, SS3, etc. To create a split sample, a single field sample (often created by compositing several samples from the same field location) is split in the field into two or more sub-samples. This is done so different types of analyses can be performed (e.g., toxicity, chemistry) or the same analyses can be performed by different laboratories. Each split or sub-sample is analyzed individually.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
V	Sample Composite Flag	Indicates that the sample is a composite created by combining two or more discrete samples collected spatially and/or temporally.	**Required if** Field Collection Type is Sample.	Alpha-numeric.	1	- **Y** - Yes - **N** - No - **U** - Unknown	Download help for "Entering Composite Samples."
W	Storm Event Qualifier	Qualifier for stormwater sampling events conducted under Washington State Municipal Stormwater Permits. Indicates if a storm event met the qualifying criteria or not and why.	**Required only** for municipal permit storm event data.	Alpha-numeric.	3	- **Q** - Meets criteria for qualifying storm event as defined in the Municipal Stormwater Permit. - **NQ1** - Non-qualifying antecedent. There was not a long enough dry period before sampling (antecedent dry period). - **NQ2** - Non-qualifying rainfall. There was not enough total rain during the sampling period. - **NQ3** - Non-qualifying inter-event. The inter-event was either too long or too short. - **NQ4** - Non-qualifying sample aliquots. Minimum number of aliquots were not obtained. - **NQ5** - Non-qualifying hydrograph. Minimum percentage of hydrograph not collected. - **NQC -** Non-qualifying criteria combination (NQ1-NQ5, see comments for details).	Download help for "Stormwater and Combined Sewer Data."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
X	**Sample Matrix**	Describes the general environmental medium which was measured or from which a sample was taken.	**Required.**	Alpha-numeric.	14	- **Air/Gas** - **Other Liquid** - **Habitat** - **Solid/Sediment** - **Tissue** - **Water**	**Tip:** the matrix for porewater is solid/sediment.
Y	**Sample Source**	Describes the environmental resource which was measured or from which a sample was taken. More specific than Sample Matrix.	**Required.**	Alpha-numeric.	30	Must be a valid EIM Sample Source Code. See table of Sample Source valid values (in this document).	Ex. “Fresh/Surface Water.”
Z	Sample Use	Indicates that the sample was collected for a specific purpose, namely background, reference, or test. Commonly used for sediment data.	**Required for** sediment data when bioassay analyses were done on the same sample.	Alpha-numeric.	1	- **B -** Background Sample - **R** - Reference Sample - **T** - Test Sample - **I** - Initial Sample (for bioaccumulation T0 (time zero) tissue concentration data only).	**Tip:** Use “B” to indicate that a sample was collected as a background sample for the Study even if it's not included in the final background calculation (due to suspected contaminant sources or other inappropriate data).
AA	Sample Collection Method	Method used to collect the sample.	**Required for** some data types like stormwater, macroinvertebrate, groundwater, and others.	Alpha-numeric.	20	Must be valid EIM Method Code. Search for EIM Method valid values (online).	Ex. "BAIL-TEF " (Bailer, teflon). Download help for learning "About EIM Methods." Need a method added to EIM? Contact us online or ask your Data Coordinator.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AB	Sample Preparation Method	Method used to prepare the sample.	**Required for** some data types like TCLP/SPLP, filtered water samples, and others.	Alpha-numeric.	20	Must be valid EIM Method Code. Search for EIM Method valid values (online).	Ex. "SW3010A" (Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy, Revision 1). Ex. “FILTER.45um.” Download help for learning "About EIM Methods." Need a method added to EIM? Contact us online or ask your Data Coordinator.
AC	Sample Method Other	Additional field for collection, preparation, or preservation method.	Optional.	Alpha-numeric.	20	Must be valid EIM Method Code. Search for EIM Method valid values (online).	Download help for learning "About EIM Methods." Need a method added to EIM? Contact us online or ask your Data Coordinator.
AD	Sample Taxon Name	Scientific or common name of the subject taxon, commonly species level. Specified when an analysis was performed by a lab on animal or plant tissue.	**Required if** Sample Source is Animal Tissue or Plant Tissue.	Alpha-numeric.	254	Must be valid EIM Taxon Name. Search for EIM Taxa valid values (online).	Ex. Species "Oncorhynchus keta" (common name "Chum salmon"). If you have **macroinvertebrate or plant COUNTS,** fill out Result Taxon Name instead. Need a critter added to EIM? Contact us online or ask your Data Coordinator.
AE	Sample Taxon TSN	Integrated Taxon Identification System (ITIS) Taxonomic Serial Numericber (TSN)	Optional.	Alpha-numeric.	10	Must be valid EIM Taxon TSN. Search for EIM Taxa valid values (online).	Ex. "161976" (TSN for species "Oncorhynchus keta").
AF	Sample Tissue Type	Type of animal or plant tissue that was sampled or measured.	**Required if** Sample Source is Animal Tissue or Plant Tissue.	Alpha-numeric.	254	Must be a valid EIM Tissue Type. Search for EIM Tissue Type valid values (online).	Ex. "Fillet, skin off" or "Whole organism, not shell."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AG	Sample Percent Sorted	Percent of sample that is sorted. For benthic macroinvertebrate and periphyton count data.	**Required for** macro-invertebrate and periphyton counts.	Numeric.	3	0-100	Ex. "30" for macroinvertebrates or "0.00001468" for periphyton. For macroinvertebrates, usually the number of grid squares counted, divided by the total number of grid squares, times 100. Periphyton count sample percent sorted will be a very small number. Download help for "Periphyton Counts." Download help for "Benthic Invertebrate Identification and Counts"
AH	**Result Parameter Name**	Name of the parameter reported for the result. Parameters are most often thought of as chemical analytes, but also include things like temperature, fish weight, flow, etc.	**Required.**	Alpha-numeric.	254	Must be a valid EIM Parameter Name. Search for EIM Parameter Names (online). Observations - use "Unable to measure."	Ex. "Cadmium" or "Fish, Number in Composite Sample." Need a parameter added to EIM? Contact us online or ask your Data Coordinator.
AI	Result Parameter CAS Number	A unique number assigned by the Chemical Abstracts Service (CAS) Division of the American Chemical Society to each distinct chemical substance recorded in the Chemical Registry System.	**Required if** Result Parameter Name is a chemical substance with a CAS Number.	Alpha-numeric.	15	Must be a valid EIM CAS Number in format: XXXXXX-XX-X to XX-XX-X. Search for EIM Parameter CAS Numbers (online).	Ex. "30002-00-9," "5905-01-1," "98-83-9," Must include dashes. Don't enter non-CAS identifiers like "temp," etc. If your lab did not supply a CAS number with your results, contact your EIM Data Coordinator. See info on CAS numbers that reformat into dates (in this document).

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AJ	Lab Analysis Date	The analysis date reported by the lab.	**Required if** Field Collection Type is Sample.	Date.	10	MM/DD/YYYY.	Ex. "06/23/1999."
AK	Lab Analysis Date Accuracy	Indicates if the Lab Analysis Date is accurate to the day, week, month, year, or unknown. Except for historical data, most cases are day.	Optional.	Alpha-numeric.	1	- **D** - day - **W** - week - **M** - month - **Y** - year - **U** - unknown	
AL	Lab Analysis Time	The analysis time reported by the lab.	Optional.	Time.	8	HH:MM:SS (24 hour).	Ex. "18:22:14."
AM	Result Value	Reported result value for a particular parameter.	**Required if** Field Collection Type is Sample or Measurement.	Numeric.	10	Must be a number. No commas, less-than (<) symbols, or NDs. No zeros for non-detects.	Ex. "4.60" (lab analysis showed soil sample contained 4.60 micrograms of cadmium). Ex. "26.2" (water level 26.2 feet below the measuring point). **Observations** – leave this field blank. N**on-detects/censored data** - record the reporting or detection limit in this field and use the appropriate qualifier (U or U-variant) in the Result Data Qualifier field. Download help for "Entering Non-Detects and Estimates."
AN	Result Value Units	Unit of measure associated with a Result Value.	**Required if** Field Collection Type is Sample or Measurement.	Alpha-numeric.	10	Must be a valid EIM Unit. Search for EIM Units (online).	**Observations** – leave this field blank. Need a unit added to EIM? Contact us online or ask your Data Coordinator.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AO	Result Reporting Limit	Minimum concentration at which detection of a parameter is reported. Usually chosen by the laboratory and usually above a parameter's method detection limit.	**Required for** non-detects and some J-qualified data. Also required for detects, if available.	Numeric.	10	Must be a number. **Value must have same units as Result Value.**	Ex. "4.60." Labs should provide this information for most data. You may not have this information for historical data. Download help for "Entering Non-Detects and Estimates."
AP	Result Reporting Limit Type	Specifies the type of Reporting Limit provided by the lab.	**Required if** you enter a Result Reporting Limit.	Alpha-numeric.	9	- **MRL** - Method Reporting Limit, - **PQL** - Practical Quantitation Limit, - **EQL -** Estimated Quantitation Limit, - **LLOQ** - Lower Limit of Quantitation (EPA SW-846 methods only), - **LOQ** - Limit of Quantitation, - **SQL** - Sample Quantitation Limit, - **CRQL** - Contract-Required, Quantitation Limit (as defined by EPA), - **LabDef** - Lab Defined (limited use), - **Unknown** - for historical data only upon approval.	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AQ	Result Detection Limit	The minimum quantity of a parameter that can be distinguished from background.	**Required** for non-detects and some J-qualified data. Also required for detects, if available.	Numeric.	10	Must be a number. **Value must have same units as Result Value.**	Ex. "2.90." Labs should provide this information for most data. You may not have this information for historical data. Download help for "Entering Non-Detects and Estimates."
AR	Result Detection Limit Type	Specifies the type of Detection Limit provided by the lab.	**Required if** you enter a Result Detection Limit.	Alpha-numeric.	9	- **MDL -** Method Detection Limit, - **EDL** - Estimated Detection Limit, - **LOD -** Limit of Detection, - **IDL** - Instrument Detection Limit, - **CRDL -** Contract-Required Detection Limit (as defined by EPA), - **MDC** - Minimum Detectable Concentration (radiochemistry), - **Unknown** - for historical data only upon approval.	

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AS	Result Data Qualifier	Standard annotations for documenting issues with Result Values, such as non-detects or estimates. Also used for: - Well Water Level Measurements. - Observations, to explain why a sample or measurement wasn't possible.	**Required if applicable.**	Alpha-numeric.	3	Must be a valid EIM Result Data Qualifier. See table of "Result Data Qualifier valid values" (in this document). OR Search for EIM Result Data Qualifier Valid Values (online).	Ex. (lab) J = Analyte positively identified. Associated numerical result is an estimate. Ex. (measurement) BAT = Instrument experienced battery issues; reported result is an estimate. Ex. (observation) FH = Flow too high to measure. Ex. (wells) WLR = Well site was pumped recently. For **non-detects**, record the reporting or detection limit in the Result Value field and the appropriate qualifier (U or UJ, etc.) in this field. Don't use the < symbol before the value or an "ND" for the value. Download help for "Entering Non-Detects and Estimates." Note: Since lab qualifiers are not universal, pick a qualifier that best-represents the one assigned by your lab.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
AT	Fraction Analyzed	Indicates the fraction (total, dissolved, or suspended) of an aqueous sample that was analyzed. Also includes analyses performed on lab-generated leachates derived from solid samples	**Required for** Samples with Sample Matrix of "Water," unless Sample Source is "Freshwater Taxonomy" or "Salt/Marine Taxonomy." Also required if you analyzed sediments which were suspended in a water column or for lab leachates.	Alpha-numeric.	15	- **Total** - analysis performed on an unfiltered or unseparated aqueous sample (dissolved + solids); - **Dissolved** - analysis performed on an aqueous sample that has been filtered in the lab or the field such that only the soluble portion is analyzed; - **Suspended** - analysis performed on solids retained from an aqueous sample after separation by filtering or centrifuging, etc.; - **Lab Leachate** - analysis performed on lab-generated leachate derived from a solid sample using TCLP or similar sample preparation.	Download help for "Fraction Analyzed." Download help for "Entering TCLP/SPLP Data."
AU	Field Filtered Flag	Indicates if a sample was filtered in the field (not the lab).	**Required if** Fraction Analyzed is Dissolved.	Alpha-numeric.	1	- **Y** - Yes, - **N** - No, - **U** - Unknown.	Document filtration method in Sample Preparation Method field (Column AB). Important for groundwater samples.
AV	Result Basis	Physical state in which the analyte concentration was reported - either as the sample was received by the lab (wet weight) or adjusted to remove moisture (dry weight).	**Required for** Sediment, Soil and Tissue chemistry data or if this information was reported by the lab.	Alpha-numeric.	3	- **Dry** - Analyte concentration in dry weight; - **Wet** - Analyte concentration in wet weight.	Result Basis is sometimes concatenated with units in lab reports. We store Result Basis and units separately in EIM. Don't populate Result Basis for Measurements, Grain Size, Percent Solids, or Water Samples – leave it blank. Download help for "Result Basis."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
A W	Digestion Method	Indicates the degree of digestion or breakdown performed on a solid sample prior to analysis.	**Required for** metals in soil and sediment unless Fraction Analyzed (Column AT) is "Lab Leachate."	Alpha-numeric.	20	- **Total** - solid sample digested with acid to free up analyte prior to analysis; includes total recoverable; - **Complete** - similar to Total, but completely dissolves solids. Often uses HF acid.	If digestion is not part of the analytical method, include it in the Sample Preparation Method field (Column AB).
AX	Water Level Accuracy	Indicates the estimated accuracy of a well water measurement or a vertical hydraulic gradient measurement.	**Required only for** well water level and vertical hydraulic gradient measurements.	Alpha-numeric.	3	**Accuracy in feet:** - **WL2 -** +0.01ft, - **WL1** - +0.1ft, - **WL0** - +1ft, - **WL6** - >1ft.	For water levels measured in meters, contact your EIM Data Coordinator.
AY	Result Method	Procedure or method used to derive a result. Includes lab (analytical), field (measurement), and derivation (calculated) methods.	**Required if** Field Collection Type is Sample or Measurement.	Alpha-numeric.	20	Must be valid EIM Method Code. Search for EIM Method valid values (online).	Ex. 'SW8260B" – Analysis Method Code with description "Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 2." Ex. "GWLMT" – Measurement Method Code with description "Groundwater level by electric tape measurement." Download help for learning "About EIM Methods." Need a method added to EIM? Contact us online or ask your Data Coordinator.
AZ	Result Comment	Comments about the Result Value.	Optional.	Alpha-numeric.	2000	Free text.	Ex. "Thermometer broke, temperature taken with new thermometer." Download help for "How to Use EIM's Comment fields."

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
BA	Result Additional Comment	Additional comments about the Result Value.	Optional.	Alpha-numeric.	2000	Free text.	Ex. "Temperature result is an estimate because thermometer not calibrated." Download help for "How to Use EIM's Comment fields."
BB	Result Lab Replicate ID	Additional ID for lab replicate samples with the same primary Sample ID.	**Required for** lab replicates with same Sample ID.	Alpha-numeric.	4	Free text / preferred format.	Ex. 1, 2, or LR1, LR2, or REX1, REX2, or DIL1, DIL2, etc. Lab (analytical) replicates are separate analyses of sub-samples created in the lab from a single field sample. They are used to assess error associated with sample heterogeneity, sample treatment, and analytical procedures - or variability of organism responses to toxicity tests. Download help for "Lab Dilutions and Re-Extractions."
BC	Result Lab Name	Name of lab that analyzed the sample.	**Required if** Field Collection Type is Sample.	Alpha-numeric.	254	Must be valid EIM Lab Name. Search for EIM Lab valid values (online).	Ex. "ALS Lab Group, Kelso WA." Don't fill this out for Measurements. Some labs have new names due to mergers. Use the name the lab was under when your samples were analyzed. Need a lab added to EIM? Contact us online or ask your Data Coordinator.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
BD	Result Validation Level	Third-party expert data validation following the most updated versions of USEPA guidance and national functional guidelines. Pre-August 2013 data follows older guidance.	**Required only for** studies where data are validated by third-party experts following USEPA guidance and national functional guidelines. This may include certain Ecology Toxics Cleanup Program (TCP) and U.S. Army Corps of Engineers (USACE) sediment studies, TCP federal studies, and TCP cleanup studies.	Alpha-numeric.	5	- **EPA1,** - **EPA2A,** - **EPA2B,** - **EPA3,** - **EPA4.** Pre-August 2013 data only: - **QA1,** - **QA2** See table of "Result Validation Level valid values" (in this document).	Most EIM data are not externally validated. If the data were not validated by third-party experts, leave this field blank and specify QA information ONLY at the Study level (Study QA Assessment Level). If your data were externally validated by third-party experts and you are using this field to indicate the EPA validation stage, set your Study QA Assessment Level to "See Results." The minimum data validation stage for Toxics Cleanup Program data is EPA2B.
BE	Result Taxon Name	Scientific or common name of the subject taxon. This is used if what you are reporting is an organism count. This is not used if an analysis was performed on animal or plant tissue.	**Required for** macro-invertebrate, periphyton, vertebrate, shellfish or plant counts or other taxonomic data submitted as counts.	Alpha-numeric.	254	Must be valid EIM Taxon Name. Search for EIM Taxa valid values (online).	Ex. "Leptoceridae" (Common name "long-horn caddisflies," Family level). If your data are not counts, but rather results from an analysis performed on animal or plant tissue, fill out Sample Taxon Name instead. Need a critter added to EIM? Contact us online or ask your Data Coordinator.

Col	Field Name	Description	Requirements	Type	Size	Valid Values and Conditions	Examples and Guidance
BF	Result Taxon TSN	Integrated Taxon Identification System (ITIS) Taxonomic Serial Number (TSN).	Optional.	Alpha-numeric.	10	Must be valid EIM Taxon TSN. Search for EIM Taxa valid values (online).	Ex. "116547" (TSN for Family "Leptoceridae").
BG	Result Taxon Unidentified Species	Indicates that a subject taxon has not been not positively identified to the species level. The next highest taxonomic level (usually genus) is indicated in the Result Taxon Name field.	**Required if** more than one unidentified species in the same sample is reported under the same parent taxon.	Alpha-numeric.	10	**SP1, SP2, SP3, SP4, SP5, SP6, SP7, SP8, SP9.**	Assign sequentially for each unidentified species in the same sample reported using the same parent taxon. Roll the Result Taxon Name and TSN up to the next taxonomic level (usually genus). Download help for "Entering Unidentified Species Data"
BH	Result Taxon Life Stage	Describes life stage of an organism.	**Required for** some macro-invertebrate taxonomic data and vertebrate and shellfish counts.	Alpha-numeric.	50	- **Adult,** - **Egg,** - **Juvenile,** - **Larva,** - **Megalopa,** - **Nauplius,** - **Nymph,** - **Pupa,** - **Unknown,** - **Zoea.**	This field is used to separate counts, for example when there are both adults and larvae of the same taxon in an individual sample. For freshwater macroinvertebrates it is required if other than larvae. For marine macroinvertebrates it's required if other than adult. Download help for "Benthic Invertebrate Identification and Counts"

Go back to Field Collector help.

EIM Field Collector valid values

Valid Value	Description
Business	Business, Trained Staff
ConsDistrict	Conservation District
Consultant	Consultant, Professional
Ecology	WA Dept of Ecology
GovFed	Government, Misc. Federal
GovLocal	Government, Misc. Local
GovState	Government, Misc. State
GovTribal	Government, Tribal
HealthLocal	Health Dept., Local
HealthState	Health Dept., State
NGO	Non-Governmental Organization
NOAA	National Oceanic & Atmospheric Administration
University	University
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
USNPS	US National Parks Service
UtilityPrivate	Utility, Private
UtilityPublic	Utility, Public
Volunteer	Volunteer, Trained
WellDriller	Well Driller
WellOwner	Well Owner
WDFW	WA Dept of Fish & Wildlife
WDNR	WA Dept of Natural Resources

Go back to Sample Source help

EIM Sample Source valid values

Air and Gas

Download help for Air, Vapor, and Soil Gas Data

Valid Value	Additional Info
Indoor Air	
Outdoor Air	
Soil Gas	Gaseous elements and compounds in the small spaces between particles of the earth and soil

Animal and Plant

Valid Value	Additional Info
Animal Tissue	
Animal Tissue - Lab Exposure	Animal tissue purposefully exposed to specific contaminants in a lab setting
Plant Tissue	
Periphyton	Mixture of algae, cyanobacteria, heterotrophic microbes, and other elements that are attached to submerged surfaces in aquatic settings.
Freshwater Taxonomy	Taxonomic information about freshwater organisms. Download help for "Benthic Invertebrate Identification and Counts"
Salt/Marine Taxonomy	Taxonomic information about salt/marine water organisms. Download help for "Benthic Invertebrate Identification and Counts"

Sediment, Porewater, and Elutriate

Valid Value	Additional Info
Freshwater Sediment	
Brackish Sediment	

Valid Value	Additional Info
Salt/Marine Sediment	
Freshwater Porewater	Porewater is the water filling the spaces between grains of sediment.
Brackish Porewater	
Salt/Marine Porewater	
Elutriate	Supernatant of a sediment and lab water mixture (this is not porewater).

Soil and Substrate

Valid Value	Additional Info
Rock/Gravel	
Soil	

Stormwater

Download help for Stormwater and Combined Sewer Data

Valid Value	Additional Info
CSO Outfall	Combined Sewer Overflow (CSO) outfall.
CSS In-Line	Combined Sewer System (CSS) in-line.
CSS Catch Basin	Combined Sewer System (CSS) catch basin.
Stormwater BMP Effluent	Stormwater, Best Management Practice (BMP) effluent.
Stormwater BMP Mid	Stormwater, Best Management Practice (BMP) treatment zone (like stormwater pond).
Stormwater BMP Influent	Stormwater, Best Management Practice (BMP) influent.
Stormwater Catch Basin	
Stormwater In-Line	Stormwater, in-line conveyance or drainage.
Stormwater Outfall	
Stormwater Sheetflow	
Precipitation	

Water

Valid Value	Additional Info
Fresh/Surface Water	
Brackish Water	
Salt/Marine Water	
Groundwater	
Pit Water	Standing water at bottom of excavation pit or trench, composed of pooled surface water runoff, groundwater seepage, or both. Download help for Entering Pit Water Data.
Precipitation	
Spring/Seep	Spring or Seep. Download help for Spring and Seep Data.

Other

Valid Value	Additional Info
Industrial Discharge	Discharge from an industrial source (permitted).
Landfill Leachate	Leachate sampled from a landfill leachate collection system.
Sewer In-Line	Sewer system, in-line.
Source - Other	Point source or discharge that is not stormwater, industrial, or WWTP.
WWTP Effluent	Wastewater treatment plant effluent.
WWTP Influent	Wastewater treatment plant influent.

Go back to Result Data Qualifier help

EIM Result Data Qualifier valid values

Lab (Sample) data qualifiers

Chose the best match to the qualifiers reported by your lab.

Qualifier	Description
B	Analyte detected in sample and method blank AND the reported result is sample concentration without blank correction or associated quantitation limit.
B1	Analyte detected in sample and method blank AND the reported result is blank-corrected.
E	Reported result is an estimate because it exceeds calibration range.
G	Value is likely greater than the reported result AND the reported result may be biased low.
J	Analyte was positively identified AND the reported result is an estimate.
JG	Analyte was positively identified AND the value may be greater than the reported estimate.
JK	Analyte was positively identified AND the reported result is an estimate with unknown bias.
JL	Analyte was positively identified AND the value may be less than the reported estimate.
JT	Analyte was positively identified AND the reported result is an estimate below the associated quantitation limit but above the MDL.
JTG	Analyte was positively identified AND the value may be greater than the reported result, which is an estimate below the associated quantitation limit but above the MDL.
JTK	Analyte was positively identified AND the reported result is an estimate with unknown bias, below the associated quantitation limit but above the MDL.
JTL	Analyte was positively identified AND the value may be less than the reported result which is an estimate below associated quantitation limit but above MDL.
K	Reported result with unknown bias.
L	Value is likely less than the reported result AND the reported result may be biased high.
N	There is evidence the analyte is present in the sample AND this is a tentatively identified analyte.
NJ	There is evidence that the analyte is present in the sample AND the reported result for the tentatively identified analyte is an estimate.

Qualifier	Description
NJT	There is evidence the analyte is present in the sample AND the reported result for the tentatively identified analyte is an estimate below the associated quantitation limit but above the MDL.
NU	There is evidence the analyte is present in the sample AND the tentatively identified analyte was not detected at or above the reported result.
NUJ	There is evidence the analyte is present in the sample AND the tentatively identified analyte was not detected at or above the reported estimate.
REJ	Data are unusable for all purposes. Results rejected due to serious deficiencies in the ability to analyze the sample or conduct a measurement and meet quality control criteria. For samples the presence or absence of the analyte cannot be verified.
T	Reported result below associated quantitation limit but above MDL
U	Analyte was not detected at or above the reported result.
UJ	Analyte was not detected at or above the reported estimate
UJG	Analyte was not detected at or above the reported estimate with likely low bias.
UJK	Analyte was not detected at or above the reported estimate with unknown bias.
UJL	Analyte was not detected at or above the reported estimate with likely high bias.

Measurement data qualifiers

Use with discrete or time series field data.

Qualifier	Description
EST	Measurement value reported is estimated. See comment for additional detail. (Note - You must add a comment to the Result Comment (column AZ) or Result Additional Comment (column BA) field explaining why your result is an estimate).
EQP	Inconsistent equipment performance (sensor, instrument, etc.); reported result meets study objectives.
IA	Instrument result adjusted; reported result meets study objectives.
OOR	Out of range; dataset not in expected range for instrument type, data type, or historical climatology; reported result meets study objectives.
OUT	Outlier within dataset; single result is unexpected or discontinuous.
REJ	Data are unusable for all purposes. Results rejected due to serious deficiencies in the ability to analyze the sample or conduct a measurement and meet quality control criteria. For samples the presence or absence of the analyte cannot be verified.

Qualifier	Description
VAR	Variation within dataset; multiple results creating an unexpected pattern.

Observation data qualifiers

Well-specific observation data qualifiers are under Well Water Level data qualifiers, in the next section.

Qualifier	Description
FA	No site access.
FD	Site was dry.
FE	Equipment failure.
FH	Flow too high to measure.
FI	Ice-impacted.
FL	Above or below instrument or method limit.
FS	Stagnant water - no flow.
FT	Flow tidally impacted.

Well Water Level data qualifiers

Includes well-specific observation data qualifiers, marked with an asterisk.

Qualifier	Description
WLA	Well water level affected by atmospheric pressure.
WLB	Well water level affected by tidal stage.
WLC	Well water level affected by ice.
WLD	Well was dry during measurement attempt*
WLE	Well was flowing recently.
WLF	Well was flowing and could not be measured*
WLG	Nearby well(s) flowing during measurement.
WLH	Nearby well(s) flowing recently.
WLI	Well site was being injected during measurement.
WLJ	Nearby well site(s) being injected during measurement.

Qualifier	Description
WLK	Water was cascading down inside of well.
WLL	Well water level affected by brackish or saline water.
WLM	Well was plugged and not in hydraulic contact with the aquifer.*
WLN	Well measurement discontinued.*
WLO	Well water level affected by/could not be measured due to obstruction in well.*
WLP	Well site was being pumped during measurement.
WLR	Well site was pumped recently.
WLS	Nearby well(s) being pumped during measurement.
WLT	Nearby well(s) pumped recently.
WLV	LNAPL (floating product) or other foreign substance on well water.
WLW	Well was destroyed and could not be measured*
WLX	Well water level affected by nearby surface-water stage.
WLZ	Well water level affected by other conditions.

Data qualifiers no longer in use

Still used with older data in EIM.

Qualifier	Description
C	See Result Comment for qualifying statement

Go back to Result Validation Level help

EIM Result Validation Level valid values

Result Validation Level is used only for Studies where data were validated by third-party experts following USEPA guidance and national functional guidelines (2009, 2014, and 2016) or the most updated versions when available from the USEPA. Use this field for third-party expert validated data following USEPA guidance and functional guidelines.

The Sampling and Analysis Plan or Quality Assurance Project Plan and study data validation report indicates what the appropriate EPA validation stage is. Applicable Ecology Toxics Cleanup Program (TCP) studies for Result Validation Level are TCP and U.S. Army Corps of Engineers sediment studies, TCP federal studies, and some TCP other cleanup studies. Consult the data validators if the validation stage is in question. If the data were not validated following USEPA guidance and functional guidelines, leave the Result Validation Level blank and instead populate the Study QA Assessment Level using the customary Level 1-5. Note that most EIM data are not externally validated.

Current Result Validation Levels

Valid Value	Description
EPA1	EPA Stage 1 verification and validation based only on completeness and compliance of sample receipt condition checks.
EPA2A	EPA Stage 2A verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results.
EPA2B	EPA Stage 2B verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results.
EPA3	EPA Stage 3 verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks.
EPA4	EPA Stage 4 verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs.

References

- USEPA National Functional Guidelines for High Resolution Superfund Methods Data Review, EPA 542-B-16-001, April 2016.
- Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA-540-R-08-005, January 2009.
- USEPA National Functional Guidelines for Superfund Organic Methods Data Review, EPA-540-R-014-002, August 2014.
- USEPA National Functional Guidelines for Inorganic Superfund Data Review, EPA-540-R-013-001, August 2014.

Historical Result Validation Levels

Prior to August 2013, QA1 and QA2 validation was applied to select datasets. Although no longer used for validation, some historical data submittals can still include them where pertinent. These valid values were formerly assigned at the Study level, but have been moved to the Result level.

Valid Value	Description
QA1	Level of quality assurance review acceptable for most sediment investigations conducted under the SMS, as well as for sediment sampling and analyses conducted to determine the suitability of dredged material for unconfined, open-water disposal at a DMMP site. A chemistry data review at this level evaluates field collection and handling, completeness, data presentation, detection limits (PQL shall not be greater than the SQS of the SMS), and the acceptability of test results for method blanks, certified reference materials, analytical replicates, matrix spikes and surrogate recoveries. A QA1 review of bioassay data covers similar field and reporting elements and evaluates the acceptability of test results for positive controls, negative controls, reference sediment, replicates, and experimental conditions (temperature, salinity, pH, dissolved oxygen). Detailed guidance on QA1 review procedures is provided in PTI (1989a) and is available from Ecology. Download Reference: PTI, 1989a. Puget Sound Dredged Disposal Analysis guidance manual: data quality evaluation for proposed dredged material disposal projects. Prepared for the Washington Department of Ecology, Olympia, WA. PTI Environmental Services, Bellevue, WA.
QA2	More vigorous level of quality assurance review appropriate for sediment data that are to be used for the development of AET values and SMS numerical chemical criteria. Also recommended in cases where the data may be used in litigation. At this level, a chemistry data review examines the complete analytical process from calculation of instrument and method detection limits, practical quantitation limits, final dilution volumes, sample size, and wet-to-dry ratios to quantification of calibration compounds and all analytes detected in blanks and environmental samples. QA2 review procedures are described in PTI (1989b), also available from Ecology. Download Reference: TI, 1989b. Data validation guidance manual for selected sediment variables. Prepared for the Washington Department of Ecology, Olympia, WA. PTI Environmental Services, Bellevue, WA.

EIM Result Parameter CAS Numbers that reformat into dates

Why does it happen?

An Excel glitch causes certain EIM Result Parameter CAS Numbers to reformat into dates when you reopen your saved CSV EIM Result template in Excel. Reopening the CSV file causes Excel to default the cell format to "General." (Note: This doesn't happen in your Result template because we preformat this field as "Text," so CAS Numbers display correctly.)

How do I prevent it?

If you need to edit your template, use your original Excel template instead of your saved CSV template. Here's a list of affected EIM Parameters with correct CAS Numbers.

Result Parameter Name	Result Parameter CAS Number ("date" format)	Result Parameter CAS Number (correct format)
(-)-Loliolide	2/6/5989	5989-02-6
[2,2'-Bifuran]-5,5'-dicarbo	1/1/5905	5905-01-1
1-Octanol, 2-butyl	2/8/3913	3913-02-8
2(3H)-Furanone, dihydro-3,5-dimethyl-	1/7/5145	5145-01-7
4-Penten-2-One, 4-Methyl-	2/3/3744	3744-02-3
5-Hexen-2-One, 5-Methyl-	9/8/3240	3240-09-8
6-Nitrochrysene	2/8/7496	7496-02-8
8-Heptadecene	4/6/2579	2579-04-6
Aceanthrenequinone	11/1/6373	6373-11-1
Azulene, 1,2,3,4,5,6,7,8-octahydro-1,4-dimethyl-7-(1-methylethenyl)-, [1S-(1 alpha,4 alpha,7 alpha)]-	12/1/3691	3691-12-1
Benzene, 1-Ethenyl-4-Ethyl-	7/7/3454	3454-07-7
Benzene, 2-Ethyl-1,3-Dimethyl-	4/4/2870	2870-04-4
Benzoic acid, 3,4-dimethoxy-, 4-[ethyl[2-(4-methoxy	6/7/3625	3625-06-7
C.I. Direct Blue 1, tetrasodium salt	5/1/2610	2610-05-1
Captafol	6/1/2425	2425-06-1
Carbadox	7/5/6804	6804-07-5

Result Parameter Name	Result Parameter CAS Number ("date" format)	Result Parameter CAS Number (correct format)
Chloropropylate	10/2/5836	5836-10-2
Cyclopentane, (4-octyldodecyl)-	9/5/5638	5638-09-5
Cyclopropane, 1,2-dimethyl-, trans-	6/4/2402	2402-06-4
Disulfoton sulfone	6/5/2497	2497-06-5
Dodine	10/3/2439	2439-10-3
Ergosta-7,22-dien-3-ol, (3.beta.,5.alpha	11/4/2465	2465-11-4
Hexadecane, 1-chloro-	3/1/4860	4860-03-1
Hexanoic Acid, 3,5,5-Trimethyl-	10/1/3302	3302-10-1
Hydrogen Sulfide	6/4/7783	7783-06-4
Isobutylparaben	2/3/4247	4247-02-3
Lenacil	8/1/2164	2164-08-1
Lithium perchlorate	3/9/7791	7791-03-9
Mancozeb	1/7/8018	8018-01-7
Niobium	3/1/7440	7440-03-1
Oxazole, 2,4-dimethyl	5/1/7208	7208-05-1
Oxydisulfoton	7/6/2497	2497-07-6
Palladium	5/3/7440	7440-05-3
PBDE-001	6/1/7025	7025-06-1
Pentadecanal-	11/9/2765	2765-11-9
Picloram	2/1/1918	1918-02-1
Platinum	6/4/7440	7440-06-4
Potassium	9/7/7440	7440-09-7
Pyrene, 4-methyl-	12/6/3353	3353-12-6

Go back to Result Parameter CAS Number help

Document revision history

Revision Date	Revision No.	Summary of Changes	Reviser(s)
9/10/2013	2013.01	Changes to EIM data model	CN
10/13/2017	3.00	Changed versioning system and made formatting updates for new help center. Moved to Word/PDF from Excel for accessibility reasons. Lab EDD requirements added.	CN
4/17/2018	3.01	Under Sample and Result Taxon, changed Latin Name to Scientific Name. Added Result Detection Limit Type MDC (Minimum Detectable Concentration – Radiochemistry)	CN
01/24/2019	3.1	Removed “Landfill Gas” and “Landfill HGCS Groundwater” from Sample Source valid values list and moved “landfill leachate” down under the Other heading. Added link to Air, Vapor, and Soil Gas Data guidance. Removed “(permitted)” from WWTP Effluent description and “(permitted or non-permitted)” from Source-Other description. Replaced links to two previous guidance documents (“Benthic Organism Counts – Freshwater” & “Benthic Organism Counts – Marine”) with the link to the new combined guidance document “Benthic Invertebrates Identification and Counts.” Fixed link to Comment document in Column J.	KC
05/08/2019	3.2	Added info about CAS numbers reformatting as dates and more CAS number examples. Updated links to new web address.	CN
11/07/2019	3.3	EIM Result Validation Level valid values list, added the EPA Stage into the descriptions	KC
12/04/2019	3.4	Added local time and time zone info to Field Collection Date fields.	CN
05/03/2020	3.5	Removed dash from Study-Specific Location ID in Field Name column. Removed Water Level Accuracy valid values in meters (WL3, WL4, WL5, WL7) and added comment in examples column.	KC
06/16/2020	3.6	Renamed link for “Naming Conventions for EIM Field Locations to “How to Name and Describe Field Locations.” Accessibility edits.	CN

APPENDIX E
LABORATORY REPORTS